Chapter 5. Energy Supply Actions

States can achieve a number of environmental and economic benefits by encouraging the development of clean energy supply as part of a balanced energy portfolio. This chapter provides an in-depth discussion of five policies that states have successfully used to support and encourage continued growth of clean energy supply in their state. The term clean energy supply is used in this chapter to describe clean, distributed generation (DG), including renewable energy and combined heat and power (CHP). While states identify renewable technologies differently, most tend to include, at a minimum, solar, wind, biomass, and landfill gas/biogas. CHP is an efficient approach to generating electric and thermal energy from a single fuel source.

The policies shown in Table 5.1 were selected from a larger set of clean energy supply strategies because of their proven effectiveness and the significant effect they can have in increasing the amount of clean energy supply in those states that adopt them. The information presented in each policy description is based on the experiences and best practices of states that are implementing the programs, as well as on other sources, including local, regional, and federal agencies and organizations, research foundations and nonprofit organizations, universities, and utilities.

Table 5.1 also lists examples of states that have implemented each type of policy or program. States can refer to this table for an overview of the policies described in this chapter and to identify other states they may want to contact for additional information about their clean energy supply policies or programs. The *For More Information* column lists the *Guide to Action* section where each in-depth policy description is located.

In addition to these five policies, states are adopting a number of related policies to maximize the benefits of clean energy supply. These policies are addressed in other sections of the *Guide to Action* as follows.

- *Lead by Example* programs provide opportunities to install clean energy supply within state buildings or purchase clean energy attributes for state buildings (see Section 3.1).

Clean Energy Policies

Type of Policy	For More Information
State Planning and Incentive Structures	
Lead by Example	Section 3.1
State and Regional Energy Planning	Section 3.2
Determining the Air Quality Benefits of Clean Energy	Section 3.3
Funding and Incentives	Section 3.4
Energy Efficiency Actions	
Energy Efficiency Portfolio Standards	Section 4.1
Public Benefits Funds for Energy Efficiency	Section 4.2
Building Codes for Energy Efficiency	Section 4.3
State Appliance Efficiency Standards	Section 4.4
Energy Supply Actions	
Renewable Portfolio Standards	**Section 5.1**
PBFs for State Clean Energy Supply Programs	**Section 5.2**
Output-Based Environmental Regulations to Support Clean Energy Supply	**Section 5.3**
Interconnection Standards	**Section 5.4**
Fostering Green Power Markets	**Section 5.5**
Utility Planning and Incentive Structures	
Portfolio Management Strategies	Section 6.1
Utility Incentives for Demand-Side Resources	Section 6.2
Emerging Approaches: Removing Unintended Utility Rate Barriers to Distributed Generation	Section 6.3

- *State and Regional Planning* activities help states identify opportunities to incorporate clean energy supply as a way to meet future load growth (see Section 3.2).
- *Determining the Air Quality Benefits of Clean Energy* describes how to incorporate the emission reductions from clean energy supply into air quality planning and related activities (see Section 3.3).
- *Funding and Incentives* describes additional ways states provide funding for clean energy supply through grants, loans, tax incentives, and other funding mechanisms (see Section 3.4).
- *Portfolio Management Strategies* include proven approaches, such as Integrated Resource Planning (IRP), that place a broad array of supply and demand options on a level playing field when comparing and evaluating them in terms of their ability to meet projected energy demand. These strategies highlight and quantify the value of energy efficiency and clean DG as a resource to meet projected load growth (see Section 6.1).
- *Utility Incentives for Demand-Side Resources* presents a number of approaches, including decoupling and performance incentives, that remove disincentives for utilities to consider energy efficiency, renewable energy, and clean DG equally with traditional electricity generation investments when making electricity market resource planning decisions (see Section 6.2).
- *Emerging Approaches: Removing Unintended Utility Rate Barriers to Distributed Generation.* This section describes how electric and natural gas rates set by public utility commissions (PUCs), can be designed to support clean DG projects and avoid unintended barriers, while also providing appropriate cost recovery for utility services on which consumers depend (see Section 6.3).

Table 5.1: Energy Supply Policies and Programs

Policy	Description	State Examples	For More Information
Renewable Portfolio Standards (RPS)	RPS establish requirements for electric utilities and other retail electric providers to serve a specified percentage or amount of customer load with eligible resources. Twenty-one states and Washington, D.C. have adopted RPS.	AZ, CA, MA, TX, WI	Section 5.1
Public Benefits Funds (PBFs) for State Clean Energy Supply Programs	PBFs are pools of resources used by states to invest in clean energy supply projects and are typically created by levying a small charge on customers' electricity bills. Sixteen states have established PBFs for clean energy supply.	CA, CT, MA, NJ, NY, OH	Section 5.2
Output-Based Environmental Regulations to Support Clean Energy Supply	Output-based environmental regulations establish emissions limits per unit of productive energy output of a process (i.e., electricity, thermal energy, or shaft power), with the goal of encouraging fuel conversion efficiency and renewable energy as air pollution control measures. Twelve states have established output-based environmental regulations.	CT, IN, MA, TX	Section 5.3
Interconnection Standards	Standard interconnection rules establish processes and technical requirements that apply to utilities within the state and reduce uncertainty and delays that clean DG systems can encounter when obtaining electric grid connection. Fourteen states have standard interconnection rules, and 39 states offer net metering.	MA, NJ, NY, TX	Section 5.4
Fostering Green Power Markets	States play a key role in fostering the development of voluntary green power markets that deliver cost-competitive, environmentally beneficial renewable energy resources by giving customers the opportunity to purchase clean energy. Green power is available in more than 40 states.	CT, MA, NJ, NM, WA	Section 5.5

5.1 Renewable Portfolio Standards

Policy Description and Objective

Summary

A renewable portfolio standard (RPS) requires electric utilities and other retail electric providers to supply a specified minimum percentage (or absolute amount) of customer load with eligible sources of renewable electricity. As of September 2005, RPS requirements have been established in 21 states plus Washington, D.C., and are a key driver for new renewable electric generation facility development in the United States (Figures 5.1.1a and 5.5.1b). Over 2,300 megawatts (MW) of new renewable energy capacity through 2003 is attributable to RPS programs (Petersik 2004). RPS is cited as the driving force behind the installation of approximately 47% of new wind capacity additions in the United States between 2001 and 2004 (Wiser 2005).

Many states have adopted RPS requirements because they are an administratively efficient, cost-effective, and market-based approach to achieving renewable electricity policy objectives. RPS requirements can be used in both regulated and restructured electricity markets.

States have tailored their RPS requirements to satisfy particular state policy objectives, electricity market characteristics, and renewable resource potential. Consequently, there is wide variation in RPS rules from state to state with regard to the minimum requirement of renewable energy, implementation timing, eligible technologies and resources, and other policy design details.

Renewable Portfolio Standards (RPS) provide states with an opportunity to increase the amount of renewable energy in a cost-effective, market-based approach that is administratively efficient.

Figure 5.1.1a: Projected New Renewable Capacity by 2015 Attributable to Existing RPS Requirements
(California compared to all other states)

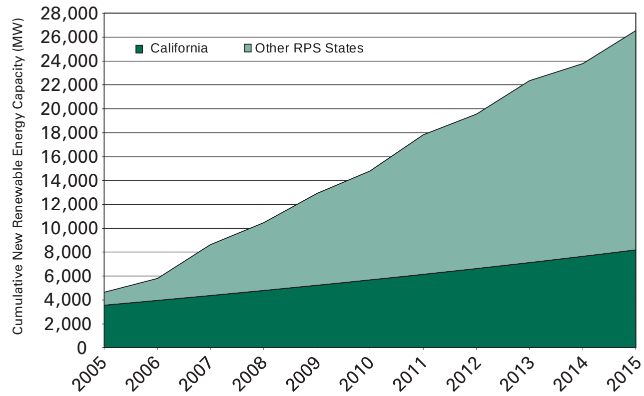
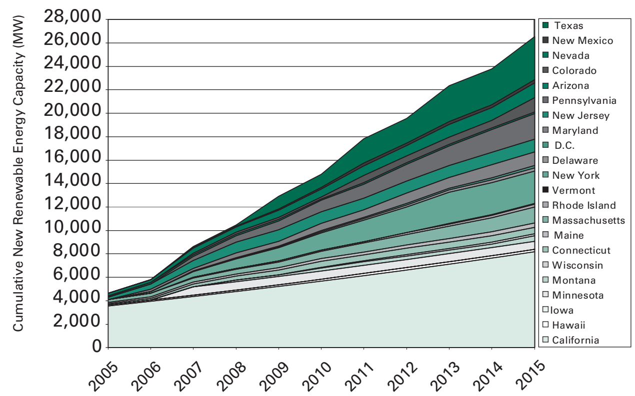


Figure 5.1.1b: Projected New Renewable Capacity by 2015 Attributable to Existing RPS Requirements
(comparison of all other states)



Source: Navigant 2005.

Electricity suppliers must demonstrate compliance with RPS requirements by any of these three mechanisms:

- Purchase electricity from a renewable facility inclusive of all renewable attributes (sometimes called "bundled renewable electricity").
- Purchase renewable energy certificates (RECs). A REC is a tradable right (separate from the electrical energy itself) to claim the environmental and other attributes associated with 1 megawatt-hour (MWh) of renewable electricity from a specific generation facility.
- Own a renewable energy facility and its output generation.

As of September 2005, 16 states allow the use of RECs to satisfy RPS requirements. Unlike bundled renewable energy, which is dependent on physical delivery via the power grid, RECs can be traded between any two parties, regardless of their location.[17] However, state RPS rules typically condition the use of RECs based on either location of the associated generation facility or whether it sells power into the state or to the regional grid. (A more detailed explanation is provided in Figure 5.1.6 on page 5-10.)

Objective

States create RPS programs because of the energy, environmental, and economic benefits of renewable energy. Many states have also adopted RPS programs to stimulate market and technology development and, ultimately, to help make renewable energy competitive with conventional forms of electric power.

Examples of broader goals and objectives that the state may want to prioritize in the RPS design process include:

- Local, regional, or global environmental benefits.
- Local economic development goals.
- Hedging fossil fuel price risks.
- Advancement of specific technologies.

Benefits

The benefits of an RPS are the same as those from renewable energy and combined heat and power (CHP)[18] in general:

- Environmental improvement (e.g., avoided air pollution, climate change mitigation, waste reduction, habitat preservation, conservation of water and other valuable natural resources).
- Increased diversity and security of energy supply, with greater reliance on domestic, regional, and in-state resources.
- Reduced volatility of power prices given the stable (or nonexistent) fuel costs of renewables.
- Possible reduction of wholesale market prices due to low bid prices of intermittent renewables in competitive wholesale markets.
- Mitigation of natural gas prices due to some displacement of gas-fired generation.
- Local economic development resulting from new jobs, taxes, and revenue associated with new renewable capacity.

Because it is a market-based program, an RPS has several operational benefits:

- Achieves renewable policy objectives efficiently and with relatively modest impacts to customer bills. State analyses performed prior to implementation of RPS requirements have shown that annual ratepayer impacts result in increases of less than 1% and savings of up to 0.5%, with the impact on residential bills of a few dollars a year (DSIRE 2005, Navigant 2005; see Figure 5.1.2). States have found the importance of performing analyses in conjunction with the design of an RPS to ensure the level is not set too high, which would result in higher costs.

17 RECs represent the attributes of electricity generated from renewable energy sources. When they are sold or traded with the physical electricity, they are considered bundled. They can be unbundled and sold or traded separately as two commodities.

18 CHP is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source by recovering the waste heat for use in another beneficial purpose.

Figure 5.1.2: A Sampling of the Impacts of RPS Requirements on Ratepayers

State	Incremental Target	Overall Rate Impacts	Average Impact on Resdential Bill
CA	41,000 GWh (2010)	Savings: 0.5% in 2010	Savings: $3.5/yr in 2010
CO	4,500 GWh (2020)	Savings: 0.5% expected value	Savings: $2.4/yr expected values
IA	4,400 GWh (2015)	Savings: 0.3% on average	Savings: $3.4/yr on average
MN	6,300 GWh (2010)	Savings: 0.7% on average	Savings: $4.6/yr on average
NY	12,000 GWh (2013)	Cost: 0.32% in 2009	Cost: $3/yr in 2009
PA	17,000 GWh (2015)	Cost: 0.46% on average	Cost: $3.5/yr on average
WA	14,300 GWh (2023)	No impact	No impact
WI	7,500 GWh (2013)	Cost: 0.6% on average after 2010	Cost: $3.3/yr on average after 2010

Source: Wiser 2005.

- Spreads costs associated with RPS requirements among all customers.
- Minimizes the need for ongoing government intervention.
- Functions in both regulated and unregulated state electricity markets.

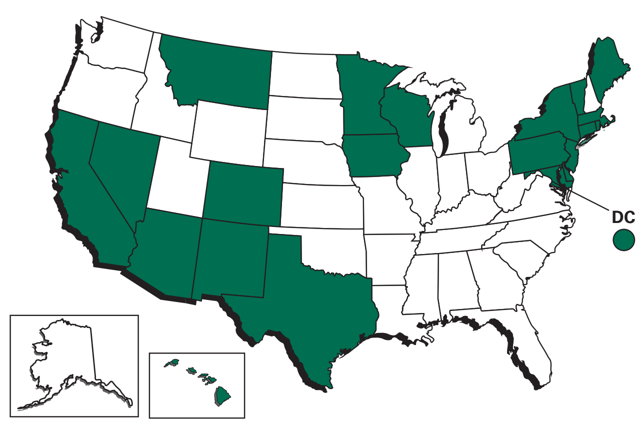
States are often finding that RPS requirements provide a cost-effective approach to achieving energy and environmental goals. RPS requirements typically lead to market development of the most cost-competitive forms of renewable energy (currently wind power in most cases), unless designed to encourage higher-cost renewable technologies.

States with RPS Requirements

As of September 2005, 21 states and Washington, D.C. have established RPS requirements (see Figure 5.1.3). Eight states enacted RPS rules in 2004 alone. In addition, Illinois has adopted legislation with a renewable energy goal of at least 5% by 2010, and at least 15% by 2020 (DSIRE 2005, Navigant 2005). The legislation does not include a verification process or any noncompliance penalties. Tremendous diversity exists among these states with respect to the minimum requirements of renewable energy, implementation timing, and eligible technologies and resources (see Figures 5.1.4 on page 5-6 and 5.1.5 on page 5-7). After initial enactment, several states have fine-tuned the RPS rules to reflect new technology, resource, or policy considerations that may have changed over time.

Initially, RPS requirements emerged as a part of deregulation of the electricity sector. Recently, however, states that are not deregulated have begun to adopt RPS requirements with an eye towards other policy concerns, such as rising natural gas and coal

Figure 5.1.3: States with RPS Requirements



Note: In Minnesota, an RPS is applicable only to the state's largest utility, Xcel Energy, which is required by special legislation to build or contract for 125 MW of biomass electricity and 1,125 MW of wind by 2011. The other Minnesota utilities must make a good faith effort to meet a Renewable Energy Objective, which is not mandatory.

Sources: DSIRE 2005, Navigant 2005.

Figure 5.1.4: State RPS Requirements

	Target	Solar
AZ	1.1% by 2007	0.66% by 2007
CA	20% by 2017	
CO	10% by 2015	0.4% by 2015
CT	10% by 2010	
DC	11% by 2022	0.386% by 2022
DE	10% by 2019	
HI	105 MW (2% by 1999)	
IA	105 MW (2% by 1999)	
MA	4% by 2009 (+1%/year after)	
MD	7.5% by 2019	
ME	30% by 2000 incl. some non-RE	
MN[a]	10% by 2015 (1% biomass)	
MT	5% in 2008, 10% in 2010, 15% in 2015	
NJ	6.5% by 2008	0.16% (95 MW) by 2008
NM	5% by 2006, 10% by 2011	
NV	6% by 2005, 20% by 2015	5% of portfolio
NY	25% by 2013	0.154% customer-sited by 2013
PA	18% by 2020 (8% is RE)	0.5% by 2015
RI	16% by 2019	
TX	2.7% or 2000 MW new by 2009, 880 MW existing preserved	
VT	Total incremental energy growth between 2005 and 2012 to be met with new renewables (cap 10% of 2005 sales)	
WI	2.2% by 2011	

[a] See note concerning Minnesota's RPS in Figure 5.1.3.

Sources: DSIRE 2005, Navigant 2005.

prices or climate change. To date, eight states have enacted RPS requirements as part of restructuring legislation, and 14 states have enacted RPS requirements outside of restructuring.

Designing an Effective RPS

This section describes key elements to consider in designing effective RPS requirements. These elements include participants, goals and objectives, applicability of the program, eligible technologies, program structure, and administration. The discussion that follows reflects lessons learned from states' experiences in developing and implementing RPS requirements. In addition, this section provides insights on interactions of the RPS requirements with other state and federal policies.

Participants

A number of organizations are involved in the design of RPS requirements:

- *State Legislatures.* Typically, the state legislature enacts legislation to mandate RPS requirements. However, legislation is not always necessary to introduce RPS requirements. For example, in Colorado, RPS requirements were mandated by a state ballot initiative. In New York, the state Public Utility Commission (PUC) established RPS requirements under its existing regulatory authority at the request of the governor. Governors have become increasingly involved in shaping RPS-related policies.
- *State PUCs.* State PUCs and other state agencies are generally tasked with establishing the detailed rules governing RPS requirements. In crafting detailed RPS rules, state agencies follow the intent and requirements of the enabling legislation but sometimes must resolve technical and policy issues that can influence the effectiveness of the program. In Arizona and New Mexico, RPS requirements were adopted via a regulatory process before being codified by the legislature. As of September 2005, a similar process is ongoing in Illinois.
- *Renewable Electricity Generators.* The efforts and ability of renewable electricity generators to build new facilities are critical to the success of RPS requirements. Therefore, the legitimate commercial needs of these generators are an important component of the design phase and can be addressed by facilitating long-term contracts.
- *Utilities.* Whether deregulated or vertically integrated, utilities are crucial entities in the successful implementation of RPS requirements. Ensuring that utility needs are addressed (e.g., recovery of compliance costs associated with RPS requirements) is vital to make RPS requirements effective.
- *Competitive Electric Service Providers (ESPs).* In states that have restructured, competitive ESPs that provide generation service to customers may be subject to RPS requirements. Administrative feasibility, flexibility, and compliance provisions are key concerns of many ESPs.

- *Other Stakeholders.* Developing RPS rules has involved numerous other stakeholders, including state and local government officials, environmental organizations, ratepayer advocates, labor unions, trade associations, project developers, and others.

Goals and Objectives

States have found that RPS have multiple goals, and some states aim for a broader set of objectives (Rader and Hempling 2001). As described in the *Objective* section (page 5-4), examples of the broader goals and objectives include:

- Local, regional, or global environmental benefits
- Local economic development goals
- Hedging fossil fuel price risks
- Advancement of specific technologies

These broader goals and objectives can serve as a guide to design choices for RPS requirements. It is important, therefore, to clearly articulate these goals and objectives in order to avoid protracted rule implementation debates and, ultimately, to produce the best RPS design for the state.

Applicability and Eligibility

A common element of RPS requirements is the *applicability* to investor-owned utilities and electric service providers. It is highly unusual for RPS requirements to extend to municipal utilities and cooperatives as these entities are predominately self-regulated.

Successful states have ensured that *eligibility* of a resource or technology reflects whether or not it supports the goals and objectives established for the RPS requirements. States are finding that defining which renewable energy resources and technologies qualify as eligible under RPS requirements can be a complicated process with multiple issues to consider. Issues that states have considered include:

- *Technologies and Fuel.* Which fuel sources and energy production technologies will be eligible?

Figure 5.1.5: Eligible Technologies Under State RPS Requirements

	AZ	CA	CO	CT	DC	DE	HI	IA	MA	MD	ME	MN	MT	NJ	NM	NV	NY	PA	RI	TX	VT	WI
Biomass	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Cogeneration				●			●				●					●		●				
Energy Efficiency							●									●		●				
Fuel Cells[a]				●							●	●		●	●			●				
Geothermal	●	●	●		●	●	●			●	●		●	●	●	●		●	●	●		●
Hydro		●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●
Landfill Gas	●	●	●	●	●	●	●		●	●	●		●	●	●	●	●	●	●	●	●	●
Municipal Waste		●		●	●		●	●		●	●	●	●	●		●		●			●	
Ocean Thermal		●		●	●	●	●		●	●							●		●	●		
Photovoltaics	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Solar Thermal Electric	●	●		●	●	●	●		●	●	●	●	●		●	●		●		●	●	●
Tidal		●		●	●	●			●	●	●			●			●		●	●		●
Transportation Fuels							●															
Waste Tire		●									●											
Wave		●		●	●	●	●		●	●				●			●		●	●		●
Wind	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

[a] All states shown in this figure allow fuel cells using fuel from eligible renewable sources to count towards the state's RPS. States shown in the fuel cell row also allow fuel cells to meet the RPS regardless of whether the input fuel is derived from a renewable resource.

Sources: DSIRE 2005, Navigant 2005.

Some fuel sources are universally accepted (such as wind and photovoltaics [PV]) with almost no technology or project limitations. Other fuels have been excluded (e.g., municipal solid waste [MSW] or nuclear power) or conditioned on qualifying project technologies (e.g., run-of-river hydro), project scale (e.g., "small" hydro), or project performance characteristics (e.g., "low emission" biomass combustion). For example, nine states do not consider MSW as eligible in their RPS (see Figure 5.1.5 on page 5-7).

- *Existing Versus New.* How are existing renewable resources to be treated? Do they count toward RPS compliance or not? States have typically set a date to establish what is considered an existing renewable resource versus what is new. Some state rules are designed to prevent existing renewables from capturing additional revenues relating to the RPS, which could increase ratepayer costs but not the amount of renewable generation.
- *Geographic Zone.* In what geographic area must the resources be located to be eligible in the RPS requirements (e.g., energy generation just within the state boundary or energy generation within a regional power market)? RPS requirements and other policies in neighboring states may affect this decision. To address this, states have performed cost-benefit analyses of the geographic zone and available resources. Strict in-state eligibility requirements may raise legal concerns under the Interstate Commerce Clause.
- *Central Versus Customer-Sited.* How are grid-tied and off-grid customer-sited systems considered? Are there reasons why they are treated differently?

RPS requirements have varied tremendously with respect to eligibility. Some states, such as Maine, employ fairly expansive definitions of eligible renewable electricity including both existing and new facilities, large hydro (up to 100 MW), MSW, and efficient CHP facilities (regardless of fuel source). Other states, such as Massachusetts, use a much narrower definition that excludes renewable generators in operation before the RPS requirements (unless refurbished or repowered), excludes hydro and MSW, and limits biomass facilities based on their emission performance. Still other states, such as Pennsylvania, allow energy efficiency, waste heat recovery, and certain fossil fuel generation to qualify under a more expansive "alternative energy" portfolio standard. States with more permissive eligibility provisions in RPS rules typically require a higher percentage of renewable energy than states with more restrictive definitions of eligible resources.

Structure

While RPS requirements are varied and are a relatively new policy tool, experience with some program elements to date have identified best practices for structuring RPS requirements. These elements of structure include:

- *Energy Versus Capacity.* Most states have chosen to base RPS requirements targets on energy production (MWh) rather than installed capacity (MW). An energy production metric provides more incentive to use the renewable resources and, therefore, to achieve the benefits that an RPS is designed to create.
- *Time Horizon.* Adequate time is required to establish, implement, and create new renewable electricity facilities and markets. Therefore, RPS requirements with sufficiently long timelines will enable markets to develop and provide project developers and investors time to recover capital investments. Many RPS rules have been established for an extended period of time, often with an end date no earlier than 10 years after RPS requirements are fully operational. RPS requirements that are built to last will go a long way toward inspiring confidence among developers and financiers.
- *Mandatory or Voluntary.* Longevity of RPS requirements is crucial in getting projects financed. Instilling investor confidence in the REC market and other trading mechanisms related to RPS requirements is vital to developing new renewable energy projects.

  Most states use a mandatory structure with financial consequences for noncompliance. An RPS that is not enforced may do little to provide investors with sufficient assurance that financial returns will be adequate to invest in new renewable facilities, especially when renewable energy options are more expensive than conventional power supplies. In addition, compliance obligations that apply to the broadest possible group of retail sellers, including default service providers, will increase demand for renewable resources. State laws that enable inclusion of municipal utilities in RPS requirements also reduce the potential for bias in retail energy markets and broaden the base of intended benefits from RPS requirements. For example, the Colorado RPS includes municipal utilities and cooperative utilities, but they can opt-out or self-certify. If they self-certify, compliance reports are for informational purposes only.

Enforcement options are numerous, but a number of states use an Alternative Compliance Payment (ACP). Under such a policy, in the event that a retail supplier cannot meet its RPS, it may instead pay a per-kilowatt-hour (kWh) charge for the amount by which it is out of compliance. The ACP rates vary, generally ranging from 1 to 5 cents per kWh, with even higher amounts for solar-specific RPS requirements. Some states "recycle" payments to support renewable energy development. (See the *State Examples* section on page 5-14 for examples of ACPs.)

- *Renewable Energy Mix.* States may have policy interests in promoting particular renewable energy technologies and deployment locations to advance market competitiveness or other social, economic, or environmental objectives. "Technology tiers" and "credit multipliers" are the primary approaches used to meet these objectives. A technology tier carves out a portion of the overall RPS obligation for a subset of eligible technologies. These technologies may be viewed as crucial for renewable policy objectives but less competitive due to higher cost, greater technical difficulty, or other market barriers. For example, New Jersey has a PV tier that requires, by 2008, that 0.17% of retail sales be supported by in-state solar RECs issued for PV projects.

  The most common resource tier approaches taken to date include a: (1) single tier for new resources, (2) single tier for existing and new resources, and (3) multiple-tier RPS differentiated by the vintage, fuel, or technology of the renewable resource.

  Credit multipliers, such as those used in Arizona for solar PV, provide more than 1 MWh of credit for each MWh of generation. New Mexico and Nevada use a similar approach. Credit multipliers increase the economic incentive for developers to install the specific technology that is granted the additional credit.

- *Start Dates and Amount of Renewable Energy.* A target percentage of renewable energy is a key element of an RPS. As shown in Figure 5.1.4 on page 5-6, these targets vary from 1% to 30% and are influenced by many factors, including a state's goals, renewable energy potential, and definition of eligible technologies and resources. States establishing provisions for ramping up to the specified target of renewable energy is important. Every state will have unique economic, environmental, and policy factors that lead to creation of a best fit approach. States have found that since there are no absolutes, careful analysis and modeling of the expected impacts before establishing the targets are the keys to success.

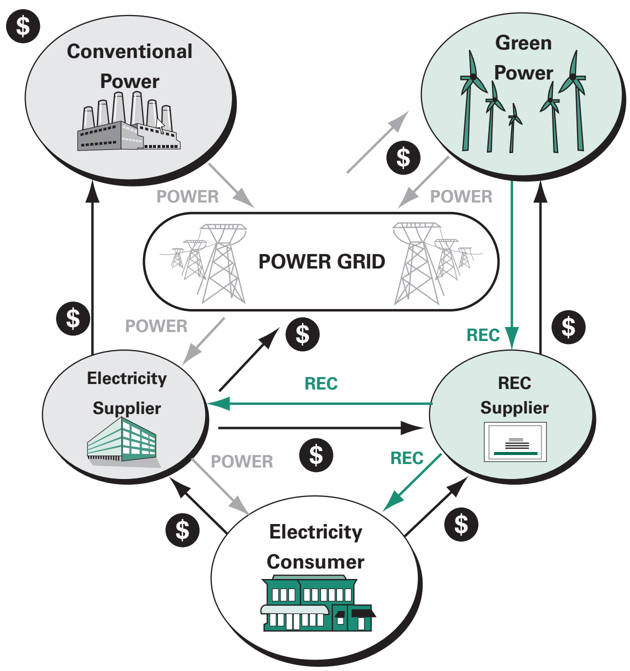
Administration

When considering how the RPS requirements will be administered, some key issues include:

- *Accounting.* It is important to regularly account for the renewable energy generated and to determine compliance with RPS requirements. Many states use RECs to determine compliance. These states include New Mexico, Massachusetts, Connecticut, Maine, New Jersey, Texas, and Wisconsin, among others. REC trading is permissible in all but four states where RPS requirements apply. These four states require bundled renewable energy (i.e., energy with attributes intact) to demonstrate compliance. (See Figure 5.1.6 for more detail on RECs and their interaction in power markets.)

- *Flexibility Mechanisms.* Because retailers may face difficulties in complying with a renewable energy purchase obligation, states are developing mechanisms that allow retailers flexibility. These

Figure 5.1.6: Illustration of Renewable Energy Credits (RECs) and Power Markets



Description of Diagram

- Green power generator produces electric power, which is delivered to the power grid and sold in the wholesale spot market.
- Green power generator is awarded RECs and sells them to an REC supplier. RECs convey the right to claim the environmental and other attributes of the green power for regulatory or marketing purposes.
- REC supplier retails some RECs directly to the consumer as a REC-based green product; no energy is sold.
- REC supplier wholesales some RECs to a retail electricity supplier, who needs them to meet RPS requirements; no energy is sold.
- Electricity supplier sells retail electricity to consumer. RPS-eligible RECs obtained by the supplier define the percentage of the electricity that is deemed renewable for RPS purposes.

Note: Conventional power is sold predominately using bilateral contracts and passes through the power grid transmission; it is easier to sell green power into the wholesale spot market. (Both are represented in this diagram within "Power Grid.")

Source: Adapted from EPA 2004.

mechanisms can allow a retail supplier to receive credit for renewable energy generated before the compliance date (e.g., credit for early compliance, forward compliance banking, REC banking) and some flexibility when compliance is not met by the specified date (e.g., deficit banking, true-up period).

- *Cost Recovery.* Renewables can command a premium cost in the marketplace. However, recent increases in natural gas and coal prices and improvements in renewable technology have negated some of the premium to the point that renewable energy is now cost-effective in some regions. Retail suppliers will buy RECs, develop renewable generation, or enter into power purchase agreements (potentially at above-market rates) to be compliant with RPS requirements. Therefore, RPS requirements generally have a mechanism to enable the utility to pass eligible costs on to retail customers via existing rate structures or by a new surcharge to utility bills. In some states, system benefits charge (SBC) funds may also be used to support utility cost recovery. Competitive retail supplier rates are not regulated by PUCs, and therefore, suppliers will need to recover their costs through the rates that they charge to their customers who are subject to competitive market conditions.

  Some, but not all, RPS rules prohibit the sale of voluntary, premium-priced green power by the retail supplier as a means of compliance with RPS requirements. This policy reflects the perspective that voluntary green power sales are intended to have an impact by being incremental to RPS requirements, and not simply offset sales that otherwise would have occurred and been paid for by all customers under the RPS. For example, the New Jersey statewide green power program contains language that specifically prohibits the sale of RECs used for RPS compliance in green power programs, and vice versa. For more information on the interaction between RPS and green power markets, see Section 5.5, *Fostering Green Power Markets*.

- *Cost Caps.* Because of the uncertainty about how the renewable energy market will function in the future, cost caps may be used to impose an upper bound on ratepayer impacts. They also limit potential market abuses and create a fair and efficient alternative compliance mechanism for suppliers if the renewable energy market is underdeveloped. Depending on how it is designed, a cost cap may put a ceiling on the price of renewable energy or RECs. Generally, effective caps are low enough to limit ratepayer impacts, but high enough to encourage renewable energy development.

As an example, Massachusetts established an ACP so that any retailer under RPS compliance could choose, if necessary, to make some of its renewable energy obligation through a payment to the state rather than by obtaining renewable energy. The ACP thus functions as a cap on retailers' exposure to potentially high renewable energy prices. The ACP is set for each calendar year by the Massachusetts Division of Energy Resources (DOER). In 2005, the ACP was set at $53.19 per MWh. The ACP is paid to the Massachusetts Technology Collaborative (MTC), which can use the payments to encourage renewable energy project development in the state.

When used, ACPs typically reflect an inadequate supply of eligible renewables vis-à-vis RPS requirements and are generally recoverable by regulated utilities from the customers. On the other hand, noncompliance penalties, which may reflect willful disregard for the RPS requirements (e.g., failure to file compliance documentation), are typically not recoverable for utility providers.

Interaction with State and Federal Programs

States coordinate and leverage their RPS requirements with an array of federal and state programs and policies. States have found that analysis of regional renewable resources and RPS requirements are helpful in designing their RPS. Exploring in advance how RPS requirements interact with both state and federal policy will avoid implementation pitfalls.

Interaction with Federal Policies/Programs

- *Production Tax Credit (PTC).* Originally enacted in the 1992 Energy Policy Act (EPAct 1992), the PTC provides a tax credit for qualifying forms of renewable energy production, such as wind, biomass, geothermal, solar, and other technologies. The PTC is currently authorized through the end of 2007 and provides 1.9 cents per kWh for wind for the first 10 years of the wind farm's commercial operation. The PTC has lapsed three times[19] since first enacted, and these lapses resulted in significant decreases in project completions during those periods. State RPS requirements can be designed to provide the flexibility to accelerate or delay renewable procurement to take advantage of short-term PTC expiration or extension.
- *Transmission Facility Extension Costs.* Many large wind farms developed in recent years have required significant and costly transmissions system extensions or upgrades to facilitate grid connection. The Federal Energy Regulatory Commission (FERC) has ratemaking jurisdiction over interstate transmission facilities. Transmission line extensions can be rather costly for remotely sighted wind turbines. Whether transmission interconnection facilities are "rolled in" and paid by all system users or are assigned specifically to the new generators could significantly influence RPS compliance.
- *Proposed Federal RPS.* In the 2005 congressional session, there were bills and amendments to create a national RPS. In June 2005, the U.S. Senate, in a 52-48 vote, adopted a proposal aimed at increasing the amount of electricity that utilities generate using renewable sources. The proposal would require 10% of the power that utilities sell to the retail market to come from renewable sources.

Interaction with State Policies/Programs

- *Existing State Incentives.* A review of existing state incentives for renewable energy can identify opportunities where existing policies and programs could further support RPS requirements. For example, SBC funds targeted for renewable energy in New York, New Jersey, and Massachusetts are used to subsidize design studies or actual installation costs of projects which help meet RPS targets. In contrast, funds in Minnesota and Wisconsin are allocated to renewable energy projects that are incremental to RPS requirements. For more information on SBCs, see Section 5.2, *Public Benefits Funds for State Clean Energy Supply Programs.*

[19] (1) Expired on 6/30/99, extended in 12/99, (2) expired on 12/31/01, extended in 2/02, and (3) expired on 12/31/03, extended in 10/04.

- *Utility Regulation.* In states with a restructured electricity sector, the rules surrounding how default service is provided can affect the market for RECs. In many cases, default service providers cannot enter into long-term contracts for power supplies or purchases of RECs. This limits the ability of renewable energy developers to secure project financing, which typically requires a sufficient long-term revenue stream to ensure adequate debt coverage ratios used by project financiers.
- *Interconnection Requirements.* Renewable electricity generators usually are interconnected with the utility grid to access wholesale markets and find customers of the highest value. Some states have taken great strides in recent years to prepare for implementing RPS requirements by ensuring that interconnection rules are designed to ensure safety while avoiding excessive costs or technical requirements that can be an obstacle to RPS compliance. For more information, see Section 5.4, *Interconnection Standards*.
- *State Emissions Regulations.* State environmental regulators can review the interaction between emission rules and RPS requirements. At least six states grant nitrogen oxide (NO_x) emission allowances or other emission credits, which may have notable market value, to renewable energy projects. Some states have expressly prohibited eligible RPS resources from selling emission allowances or credits they obtain through state environmental incentive programs. Other state RPS rules are silent on this issue. If emission credits can be sold separately (and not invalidate the use of the resource for purposes of meeting RPS requirements), the cost of compliance with the RPS requirements may be reduced due to the additional revenue stream available to renewable energy project owners. Alternately, RPS requirements are intended to produce environmental benefits, and emission allowances and credits therefore remain "bundled" with renewable electricity eligible under RPS requirements and may not be sold separately.

RPS Design Choices and Approaches

Many innovations and best practices can be found in state RPS. A sampling of noteworthy elements in these rules is shown below. Additional state cases are shown in the *State Examples* section on page 5-14.

- *REC Trading.* Texas was the first state to adopt the use of RECs for compliance verification and development of an efficient renewables market. Texas regulators also saw RECs as complementary to their efforts at restructuring the broader electricity market. The use of RECs for RPS requirements and other voluntary markets is now becoming typical in state RPS rules.
- *Centralized Procurement.* New York is the first and only state thus far where a state agency, rather than the utility or retail supplier, is responsible for procuring the renewable energy attributes. In New York, the distribution utility collects a surcharge on electricity delivered to each customer. The funds are turned over to the state. The New York State Energy Research and Development Authority (NYSERDA) then uses the funds to purchase the renewable attributes by soliciting bids from developers.
- *Stakeholder Review.* After Massachusetts adopted legislation mandating RPS requirements, the

Best Practices: Designing an RPS

The best practices identified below will help states design an RPS. These best practices are based on the experiences of states that have RPS requirements.

- Develop broad support for an RPS, including top-level support of the governor and/or legislature.
- Clearly articulate all RPS goals and objectives, since these will drive RPS rules and structure.
- Specify which renewable energy technologies and resources will be eligible, driven by the stated goals and objectives. Also consider state and regional resource availability if a goal/objective is to encourage resource diversity through a technology tier. Then, determine the mix and amount of renewable energy desired.
- Finally, consider using energy generation (not installed capacity) as a target, establish a long timeline to encourage private investment, make compliance mandatory for all retail sellers, make enforcement credible, allow utility cost recovery, establish cost caps, and consider flexible compliance mechanisms.

Massachusetts DOER (the implementing agency) conducted an extensive stakeholder consultation process and commissioned a wide-ranging analytical review of design issues related to RPS requirements. This review process led to the creation of 12 white papers on key RPS requirement topics with key insights and analytical support for eventual design choices (MA DOER 2002).

- *Technology Tiers.* The Arizona RPS requirements (called an Environmental Portfolio Standard), created in 2001, was one of the first RPS to establish a technology tier approach. Arizona mandated that at least 50% of renewable energy requirements come from solar electric sources as of 2001 and 60% by the 2004–2012 time frame. A number of states have followed suit and have used technology tiers in subsequent development of RPS requirements.

Program Implementation and Evaluation

This section provides an overview of implementation and evaluation of RPS requirements.

Roles and Responsibilities of Implementing Organization

The state entity enacting RPS requirements (e.g., the state legislature) will want to name one agency as the primary implementation authority. A number of agencies and organizations will likely be involved in the implementation regardless of which agency is named as lead. These include:

- *State PUCs* will be involved in enforcing RPS requirements and overseeing cost and ratepayer issues.
- *State Energy Offices* or similar State Public Benefit Corporations (e.g., NYSERDA) and quasi-public agencies (e.g., MTC or Connecticut Innovations Incorporated [CII]) may be involved in siting and permitting of new facilities or identifying existing facilities that could help meet RPS requirements. These agencies may also be involved in "making the market" by providing support to emerging REC markets and administering system benefits funds that are targeted toward enhancing compliance with RPS requirements.
- *Independent System Operators (e.g., Texas/Energy Reliability Council of Texas [TX/ERCOT]) or Regional Transmission Operators* may be involved in administering RECs or contracts related to compliance.

Best Practices: Implementing an RPS

The best practices identified below will help states implement an RPS. These best practices are based on the experiences of states that have implemented an RPS.

- Identify the most appropriate "lead" agency or organization for implementation authority of the RPS.
- Establish a transparent and easy-to-use accounting system for compliance.
- Provide retail suppliers with some flexibility in their compliance.
- Make sure a credible noncompliance mechanism is in place in the form of penalties.
- Conduct a mid-course performance review and enact modifications if warranted and if consistent with the original intent of the RPS.

Evaluation

Ongoing evaluation of RPS requirements is key to their success. The enabling legislation for RPS requirements sometimes includes provisions for annual or periodic evaluation and reporting of progress. Massachusetts, for example, requires an annual report. In some states, evaluations have identified serious implementation problems that have necessitated mid-course corrections. Examples of modifications that states have made to existing RPS rules are presented as follows.

- *Arizona* developed an Environmental Portfolio Standard (EPS) in 2001 that required 1.1% renewable energy by 2007, 60% of which was to come from solar. Based on the findings of the Cost Analysis Working Group and a series of workshops, the Arizona Corporation Commission staff determined that the Arizona EPS requirements were inadequate and could be increased significantly.

Challenges: Potential Market Constraints on Meeting RPS Supply

Private sector development of renewable energy projects, which may be necessary to meet a state's RPS requirements, could be constrained without access to private finance and long-term REC contracts. There are two factors that may hinder finance for renewable energy projects in deregulated markets.

1. Short-term power supply contracts

Problem: Default service providers are often limited by restructuring rules to short-term contractual arrangements for purposes of securing default service power supply and RECs. However, a developer might be required to have a long-term power contract in order to obtain private finance.

Potential Solution: In order to facilitate private investment in renewable energy projects, state regulators may want to change the way default service providers contract for power, allowing default service providers to enter into long-term service contracts from renewable generators. In order to limit the service provider's price risk, regulators could limit this policy to a relatively small percentage of total default service load. One approach is emerging in New Jersey, where regulators have included a defined percentage of renewable energy for RPS compliance in their three-year Basic Generation Service Auctions.

2. Uncertainty of REC market

Problem: Market players, such as utilities and competitive ESPs, are reluctant to enter into long-term contracts for RPS compliance RECs. This may be explained by limitations imposed on utilities in their purchase of long-term energy supplies or RECs, or uncertainties about the permanence of existing RPS provisions.

Solution: Since instilling investor confidence in the REC market is critical for developing new renewable energy projects, states could find ways to offer renewable energy project developers long-term REC contracts. One approach implemented by the Massachusetts Renewable Energy Trust (MRET) in 2003 is to use SBC funds for establishing REC contracts of up to 10 years for RPS-eligible projects. In this manner, the state is offering project developers bankable, long-term revenue from an investment grade entity (a state agency with money in escrow). (See RET 2006.)

Source: Navigant 2005.

In 2004, the staff proposed amendments that would raise the EPS requirements to 5% by 2015 and 15% by 2025, 20% of which would come from solar and 25% of which would come from distributed generation (DG).

- *Connecticut* initially exempted utility default service from the RPS requirements. Because most customers remained on default service, revisions to the RPS requirements, which were enacted in June 2003, changed the rules to require all retail suppliers to comply with the RPS requirements.

While scheduled policy evaluations are important, experience has shown that altering RPS policy midstream without sufficient justification or consistency with the original legislative intent of the RPS can hinder the program. The danger is that, if long-term certainty and stability in the policy is lacking, then facility developers and regulated retail providers may delay plans and projects and fail to deliver the results intended by the RPS.

State Examples

The following state examples illustrate the diverse types of RPS requirement design approaches, policy objectives, and implementation strategies that states have deployed. Each example highlights a particular design issue or policy objective. For projected new renewable capacity attributable to existing RPS requirements, see Figures 5.1.1a and 5.1.1b on page 5-3.

Arizona

The Arizona Corporation Commission (ACC) developed an EPS, which took effect in March 2001. The EPS requires regulated utilities to generate a certain percentage of their electricity using renewable energy.

The eligible technologies include solar PV, solar water heating, solar air conditioning, landfill gas, and biomass. Unlike many other RPS requirements around the country, the nonsolar portion of Arizona's EPS is limited strictly to in-state resources. The Arizona EPS illustrates RPS requirements built on very aggressive technology tiers (e.g., the solar set-aside component) that recognize the important system-wide benefits that solar technologies can provide. Initially, it was proposed that solar would make up 60% of the total renewables requirement from 2004 to 2012. Due to heavy reliance on solar PV, which can be a more costly renewable resource than others in the EPS, the overall renewables requirement is lower as a percentage of total generation when compared to RPS requirements of other states. Initially, the EPS target between 2007 and 2012 for renewable electricity generation was 1.1%. However, ACC staff proposed amendments in 2005 to increase the EPS to 5% by 2015 and 15% by 2025, with 20% of that requirement to be met using solar. The continuing emphasis on solar technologies for a substantial part of the overall RPS target is raising some concerns about the ability of utilities to meet the RPS requirements within prescribed ratepayer funding mechanisms.

Web site:
http://www.cc.state.az.us/utility/electric/environmental.htm

California

The legislation for California's RPS requirements was enacted in September 2002. California's RPS requirements are among the most aggressive in the country, since they require retail sellers of electricity to purchase 20% renewable electricity by 2017. At a minimum, retailers must increase their use of renewable electricity by 1% each year. California is considering increasing its RPS requirements to 33% in 2020.

Although there are some restrictions, the following technologies are eligible under the RPS: biomass, solar thermal, solar PV, wind, geothermal, fuel cells using renewable fuels, small hydropower (< 30 MW), digester gas, landfill gas, ocean wave, ocean thermal, and tidal current. In some cases, municipal solid waste is also eligible.

The legislation for the RPS requirements directs the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC) to work together to implement the RPS requirements and assigns specific roles to each agency. Currently, investor-owned utilities are required to participate (as are ESPs, once the rules are established); municipal utilities are mandated to implement and manage their own initiatives related to increasing renewable energy in their energy portfolios.

Given the financial position of the distribution utilities in the state following the energy crisis in 2000, subsequent legislation offered production incentives (referred to as supplemental energy payments) for the above-market costs of eligible procurement by investor-owned utilities to fulfill their obligation related to RPS requirements.

Web site:
http://www.energy.ca.gov/portfolio/index.html

Massachusetts

The drafting of Massachusetts' RPS requirements began as a result of electric utility restructuring in 1997. In April 2002, the Massachusetts DOER finalized the regulation. In 2003, the DOER required retail electric suppliers to use 1% renewable energy in their overall supply. By 2009, retail electric suppliers must reach 4%, after which the RPS requirements will increase 1% each year until the DOER determines that additional requirements are no longer necessary. The percentage requirements do not translate into hard MW as they are based on the suppliers' overall supply.

Eligible technologies include: solar, wind, ocean thermal, wave, tidal, fuel cells using renewable sources, landfill gas, and low emissions and advanced technology biomass. Existing renewable facilities are allowed, as long as they were installed after 1997. However, if they comply with all technical criteria, facilities installed before 1997 can obtain a waiver that qualifies the quantity of their electricity output each year that exceeds their historical generation rate.

To reduce the risk to retail suppliers associated with acquiring affordable renewable energy, the DOER allows retailers to submit an ACP as an alternative to purchasing or generating renewable energy. The price of the ACP is set annually (e.g., $53.19 per MWh in 2005).

Web site:
http://www.mass.gov/doer/rps/index.htm

Texas

Texas was among the first states to establish RPS requirements and is considered by many policymakers and advocates to be among the most successful. Since Texas passed an RPS in 1999, 1,187 MW of renewable energy capacity has been installed in Texas as of February 2005.

The Texas Renewable Generation Requirement (RGR), issued by the Texas Public Utility Commission in 1999, requires that 2,000 MW of new capacity be installed by 2009. Texas initially used a total capacity requirement (MW), which the Texas PUC later converted into a generation requirement (MWh). Texas allocates a share of the mandated new renewable generation to all retail suppliers based on a prorated share of statewide retail energy sales.

The Texas RPS requirements have been successful in part because of good renewable energy resources in the state. However, success also resulted from key provisions in the legislation, including: (1) high renewable energy requirements that triggered market growth in the state, (2) use of RECs for meeting targets, (3) credible penalties for noncompliance, and (4) inclusion of all electricity providers.

The qualifying resources include: solar, wind, geothermal, hydroelectric, wave or tidal, biomass, and biomass-based waste products (e.g., landfill gas).

The PUC in Texas established a REC trading program. A penalty system also exists. Fines are set at the lesser of $50/MWh or 200% times the average cost of REC for the year.

The RPS requirements include all retail energy providers if they have opted into retail competition (i.e., investor-owned utilities, competitive energy service providers, municipal utilities, and cooperative utilities). Otherwise, they are exempt. This requirement differs from those of many other states that often make participation by public power entities optional.

Texas has changed transmission rules to accommodate the amount of wind power developed as a result of the RPS requirements. It should be noted that there are ongoing transmission line questions, focusing on the cost to upgrade and add lines, surrounding the RPS (ERCOT 2005).

The RPS requirements have had clear positive economic impacts on the state. The tax base in the rural west has grown as a result of more than $1 billion of new wind development. This new source of local income provides much-needed resources for local services, including schools, hospitals, and emergency services. The RPS requirements have also supported hundreds of manufacturing jobs and other opportunities related to the wind industry statewide.

Web site:
http://www.puc.state.tx.us/rules/subrules/electric/25.173/25.173ei.cfm

Wisconsin

In 1999, the Wisconsin legislature established an RPS requiring investor-owned electric utilities, municipal electric utilities, and rural electric cooperatives (electricity providers) to meet a gradually increasing percentage of their retail sales with qualified renewable resources. Wisconsin's RPS requirements went into effect in October 1999 and require 2.2% renewable supply by the end of 2011. As of early 2005, Wisconsin had already secured enough renewable energy to meet their requirements through 2011.

The enabling legislation expressly allows Wisconsin electricity providers the option of using Renewable Resource Credits (RRCs) in lieu of providing renewable electricity to their customers. An RRC trading system is in operation and there is a penalty system for violations.

Eligible technologies include fuel cells that use renewable fuel, tidal or wave power, solar thermal electric, solar PV, wind power, geothermal electric, biomass, and hydropower (< 60 MW).

Wisconsin is considering increasing its RPS requirements, and studies show that the state has adequate renewable sources to make this a reasonable objective.

Web site:
http://psc.wi.gov/

What States Can Do

Action Steps for States

RPS accelerates the development of renewable and clean energy supplies. Benefits include a clear and long-term target for renewable energy generation that can increase investors' and developers' confidence in the prospects for renewable energy. States have chosen from a wide variety of approaches and goals in developing their RPS requirements. The "best practices" common among these states have been explored above. Action steps are outlined below.

States with existing RPS requirements have made it a priority to identify and mitigate issues that might adversely impact the success of the program. The longevity and credibility of the RPS requirements is crucial for investment in new renewable projects. More specifically, states with existing RPS requirements can:

- Monitor the pace of installing new renewable projects to ensure that the renewable resources needed to meet RPS goals will be in place. If adequate resource development is lagging, identify the reasons for any delay and explore possible mitigation options. For example, adequate transmission planning and policies often present obstacles to successful RPS implementation.
- Monitor utility and retail supplier compliance and the impact on ratepayers. Any significant, unanticipated adverse impacts on ratepayers can be addressed through implementing or adjusting cost caps or other appropriate means.
- Evaluate the scope of eligible technologies and, as needed, consider adding eligible technologies or altering the percentage requirements. At the same time, it is important to recognize that long-term stability and certainty of policy are important and frequent changes may undermine the success of RPS requirements.

Broad political and public support for establishing renewable energy goals have been an important part of establishing RPS requirements. Many states have found that after establishing general support for goals, it is helpful to hold facilitated discussions among key stakeholders regarding appropriate RPS design. More specifically, states that do not have existing RPS requirements can:

- Establish a working group of interested stakeholders to consider design issues and develop recommendations for RPS requirements.
- Analyze costs and benefits as in New York and Texas.
- Publicize RPS goals as they are reached to ensure that state officials, pubic office holders, and the public know that the RPS requirements are working and achieving the desired results.

Related actions that states can take include:

- Consider the need for additional policies or regulations that will help make RPS requirements successful. Transmission-related policies have proven to be critical to the success of large wind farms that are some distance from load centers and require transmission line extensions or upgrades. Ratemaking provisions that allow such upgrades to be treated as general system investments, which are funded by all users of the transmission system, help alleviate significant cost hurdles that can impede otherwise excellent wind projects.
- Consider adopting (or improving) net metering and interconnection standards to facilitate customer-sited clean DG projects that may be eligible technologies under an RPS.

Information Resources

General Information

Title/Description	URL Address
Evaluating Experience with Renewables Portfolio Standards in the United States. Wiser, R., K. Porter, and R. Grace. Prepared for the Conference Proceedings of Global Windpower. Chicago, IL: March 28-31, 2004. Ernest Orlando Lawrence Berkeley National Laboratory (LBNL), Berkeley, CA. LBNL-54439. This document provides a comprehensive analysis of U.S. experience with RPS, including lessons learned.	http://eetd.lbl.gov/EA/EMP/reports/54439.pdf
Interwest Energy Alliance Benefits of Renewable Energy. Interwest Energy Alliance is a trade association that brings the nation's wind energy industry together with the West's advocacy community. This document provides the answers to some questions about renewable energy, including economic and environmental benefits.	http://www.interwestenergy.org/benefits.htm
Projecting the Impact of RPS on Renewable Energy and Solar Installations. Wiser, R. and K. Bollinger. January 20, 2005. This PowerPoint presentation estimates and summarizes the potential impacts of existing state RPS on renewable energy capacity and supply, and of state RPS solar set-asides on solar PV capacity and supply.	http://www.newrules.org/de/solarestimates0105.ppt
Union of Concerned Scientists. Plugging in Renewable Energy: Grading the States. This report assigns grades to each of the 50 states based on their commitment to supporting wind, solar, and other renewable energy sources. It measures commitment by the projected results of renewable energy.	http://www.ucsusa.org/clean_energy/clean_energy_policies/plugging-in-renewable-energy-grading-the-states.html
Union of Concerned Scientists. Real Energy Solutions: The Renewable Electricity Standards, Fact Sheets. A national renewable energy standard (RES) can diversify our energy supply with clean, domestic resources. It will help stabilize electricity prices, reduce natural gas prices, reduce emissions of carbon dioxide and other harmful air pollutants, and create jobs—especially in rural areas—and new income for farmers and ranchers. This fact sheet provides an overview of RES.	http://www.ucsusa.org/clean_energy/clean_energy_policies/real-energy-solutions-the-renewable-energy-standard.html
Union of Concerned Scientists. Renewable Electricity Standards at Work in the States. In a growing number of states, RES—also called RPS—have emerged as an effective and popular tool for promoting a cleaner, renewable power supply. This fact sheet gives an overview of some state RES.	http:www.ucsusa.org/clean_energy/clean_energy_policies/res-at-work-in-the-states.html

Information About Federal Resources

Title/Description	URL Address
EPA CHP Partnership. This is a voluntary program that seeks to reduce the environmental impact of energy generation by promoting the use of CHP. The Partnership helps states identify opportunities for policy developments (energy, environmental, economic) to encourage energy efficiency through CHP. The Partnership can provide information and assistance to states considering including CHP or waste heat recovery in their RPS requirements.	http://www.epa.gov/chp/
EPA Green Power Partnership. This program provides assistance to renewable generators in marketing RECs and helps educate potential REC buyers about resources. The Partnership may be of assistance to states that employ RECs as a compliance measure for their RPS requirements but also allow for purchase and retirement of RECs for organizational "green power" designation.	http://www.epa.gov/greenpower

Information on Selected State Programs

State	Title/Description	URL Address
Arizona	Arizona Corporation Commission (ACC) Environmental Portfolio Standard Developments. This site is the ACC archive on RPS rules, suggested amendments, workshops, and public comment.	http://www.cc.state.az.us/utility/electric/environmental.htm
California	California Energy Commission (CEC) Renewables Portfolio Standard. This site provides an overview of the California RPS and a link to Senate Bill 1078.	http://www.energy.ca.gov/portfolio/index.html
Massachusetts	Massachusetts Division of Energy Resources (DOER): Renewable Portfolio Standard Web Site. This Web site provides an archive on the state's RPS requirements, rulings, and subsequent actions.	http://www.mass.gov/doer/rps/index.htm
	Massachusetts DOER: RPS Papers and Reports. This DOER Web site provides links to white papers that served as a basis for discussion of RPS design and implementation issues.	http://www.mass.gov/doer/programs/renew/rps.htm#papers
	Massachusetts DOER: Renewable Portfolio Standard, RPS Annual Reports. The RPS regulations (at 225 CMR 14.10(2)) require DOER to issue an Annual Energy Resource Report summarizing certain information from the Annual Compliance Filings.	http://www.mass.gov/doer/rps/annual.htm
	Massachusetts Technology Collaborative. Renewable Portfolio Standard. This Web site describes the components of the state's RPS and provides a link to information about renewable energy certificates that are a tool for implementing the RPS.	http://www.masstech.org/cleanenergy/policy/rps.htm
New York	New York State Public Service Commission: Retail Renewable Portfolio Standard. This site provides an archive of documents on New York RPS requirements.	http://www.dps.state.ny.us/03e0188.htm
Texas	Public Utility Commission of Texas: Goal for Renewable Energy. This site provides the Texas PUC's archive of documents on RPS requirements.	http://www.puc.state.tx.us/rules/subrules/electric/25.173/25.173ei.cfm
	Transmission Issues Associated with Renewable Energy in Texas. Informal White Paper for the Texas Legislature, 2005. This document provides data for consideration by legislators in evaluating bills to expand the Texas RPS.	http://www.ercot.com/news/presentations/2006/RenewablesTransmissi.pdf
Wisconsin	Evaluating the Impacts of Increasing Wisconsin's Renewable Portfolio Standard. University of Wisconsin-Madison for the Wisconsin Department of Administration, Division of Energy Renewable Energy Assistance Program. This study considered the economic impact to Wisconsin of four scenarios for future RPS standards.	http://www.ucsusa.org/assets/documents/clean_energy/UW_RPS_Final_Report_10-31-03.pdf

References

Title/Description	URL Address
DSIRE. 2005. Database of State Incentives for Renewable Energy (DSIRE) Web site. A comprehensive source of information on state, local, utility, and selected federal incentives that promote renewable energy, including a state-by-state description of RPS requirements. Accessed 2005.	http://www.dsireusa.org/
EPA. 2004. Guide to Purchasing Green Power. Produced in a joint effort between EPA, DOE, the World Resources Institute, and the Center for Resource Solutions. September 2004, p. 10.	http://www.epa.gov/greenpower/pdf/purchasing_guide_for_web.pdf
ERCOT. 2005. Transmission Issues Associated with Renewable Energy in Texas. Informal White Paper for the Texas Legislature, 2005. Produced in a joint effort between the industry and the ERCOT Independent System Operator (ISO).	http://www.ercot.com/AboutERCOT/TexasRenewableWhitePaper2005/RenewablesTransmissionWhitePaperFINAL.pdf
MA DOER. 2002. Massachusetts DOER RPS Policy Analysis has a series of white papers that cover many topics related to RPS requirements in great detail. The papers were developed during the creation of the Massachusetts RPS requirements. December 16.	http://www.mass.gov/doer/programs/renew/rps.htm
Navigant. 2005. Company intelligence. Navigant Consulting Inc. Also see: Katofsky, R. and L. Frantzis. 2005. Financing renewables in competitive electricity markets. Power Engineering. March 1.	http://www.navigantconsulting.com/A559B1/navigantnew.nsf/vGNCNTByDocKey/PPA91045514813/$FILE/Financing%20Renewables%20in%20Competitve%20Electricity%20Markets_Power%20Engineering_March%202005.pdf
Petersik, T. 2004. State Renewable Energy Requirements and Goals, Status through 2003. U.S. EIA. July.	http://www.mass.gov/doer/programs/renew/rps.htm
Rader, N. and S. Hempling. 2001. The Renewables Portfolio Standard: A Practical Guide. Prepared for the National Association of Regulatory Utility Commissioners. February.	http://www.naruc.org/displayindustryarticle.cfm?articlenbr=15688&searchcriteria=Renewable%20Portfolio%20Standard&securetype=All&startrec=1
RET 2006. Renewable Energy Trust Web site. Massachusetts Green Power Partnership.	http://www.masstech.org/RenewableEnergy/mgpp.htm
Wiser, R. 2005. An Overview of Policies Driving Wind Power Development in the West. Ernest Orlando LBNL, Berkeley, CA. February.	http://www.nationalwind.org/events/transmission/western/2005/presentations/Wiser.pdf

5.2 Public Benefits Funds for State Clean Energy Supply Programs

Public benefit funds (PBFs) can increase clean energy supply and enhance state economic development and environmental improvement. A clean energy fund can be designed to address key market barriers including the upfront cost of equipment and to provide consumer and education outreach.

Policy Description and Objective

Summary

Public benefits funds (PBFs), also known as system benefits charges (SBCs) and clean energy funds, are typically created by levying a small fee or surcharge on electricity rates paid by customers (i.e., for renewable energy, this fee is approximately 0.01 to 0.1 mills[20] per kilowatt-hour [kWh]) (DSIRE 2005). To date, PBFs have primarily been used to fund energy efficiency and low-income programs (see Section 4.2, *Public Benefits Funds for Energy Efficiency*). More recently, however, they have also been used to support clean energy supply (i.e., renewable energy and combined heat and power [CHP]).

PBFs were initially established during the 1990s in states undergoing electricity market restructuring. The goal was to assure continued support for renewable energy and energy efficiency programs in competitive markets and ensure that low-income populations had access to quality electrical service.[21] With respect to renewable energy, the concern was that in a competitive market, lower-cost generation would be favored over renewable energy. In response to this concern, PBFs were seen as a mechanism for continuing support for renewable energy and the benefits it provides in a competitive market situation.

CHP projects have been included in PBF-funded programs more recently due to their very high efficiency and environmental benefits. Although typically not considered a renewable energy technology, CHP can be characterized as a clean energy technology, a super-efficient generating technology, or an energy efficiency technology. As such, it has been addressed through both renewable and energy efficiency PBF-funded programs. States that have included CHP as an energy efficiency measure include New York and New Jersey (see *State Examples* section on page 5-26 for results of these CHP programs). This flexibility allows states to include CHP in PBF-funded programs where it makes most sense for that state, as a clean energy technology, an energy efficiency technology, or a super-efficient generating technology.

In 2005, 16 state renewable energy programs were expected to provide more than $300 million in support of clean energy supply. PBFs (i.e., clean energy funds) provided much of this funding (see Figure 5.2.1), and according to one estimate, PBFs will generate more than $4 billion for clean energy by 2017 (UCS 2004). In comparison, PBFs were expected to provide over $1 billion in funding for energy efficiency programs in 2005. (For more information on PBFs for energy efficiency, see Section 4.2, *Public Benefits Funds for Energy Efficiency.*)

Because state clean energy funds for energy supply are a relatively recent policy innovation, it is too early to measure their success. While some states track clean energy fund metrics (e.g., the number of dollars invested, number of kilowatts [kW] installed, and number of installers trained), larger issues such as the impact of clean energy funds on the renewable energy market have not yet been systematically evaluated.

Objective

The key objective of creating state clean energy funds with PBFs is to accelerate the development of renewable energy and CHP within a state. The objectives underlying a push for more renewable energy include state economic development, environmental

20 1 mill = one-tenth of a cent.

21 In California, these were initially called "stranded benefits" charges.

Figure 5.2.1: Estimated 2005 Funding Levels for State Renewable Energy Programs

	Est. 2005 Funding ($ millions)	Additional Information
AZ	$8.5[a]	To be determined in 2005
CA	$140	Through 2011
CT	$20	Through 2012
DE	$1.5[b]	Undefined end date
IL	$5	$50 million over 10 years
MA	$24	Undefined end date
ME	Voluntary	
MN	$16	Undefined end date; tied to Xcel Nuclear Prairie Island plant operation
MT	$2	2005
NJ	$68	2005–2008, 37% of SBC funding
NY	$9	$67 million over 5 years from 2002 to 2006
OH	$1.25	Through 2011
OR	$11	Through 2009
PA	$5.5	Through 2006
RI	$3.0	Through 2012
WI	$1.3	4.5% of SBC funding

Note: Values shown are annual amounts for renewable energy only and do not represent total SBCs.

[a] In 2005 Arizona was estimated to generate $8.5 million from PBFs and an additional $11–11.5 million from a utility bill surcharge for renewable energy. Funds are given to utilities to comply with the Environmental Portfolio Standard (EPS) through green power purchases, development of renewable generation assets, and customer photovoltaic (PV) rebates. Arizona is currently modifying EPS rules, which could result in the elimination of PBFs for renewable energy, and instead create a utility bill surcharge to generate ~$50 million per year.

[b] Amount represents both renewable energy and energy efficiency programs.

Sources: DSIRE 2005, Navigant 2005.

improvement, and response to public demand. These objectives can be advanced, in part, by creating a clean energy fund that incorporates a variety of strategies, including lowering equipment costs, addressing market barriers, and providing consumer education and outreach.

Benefits

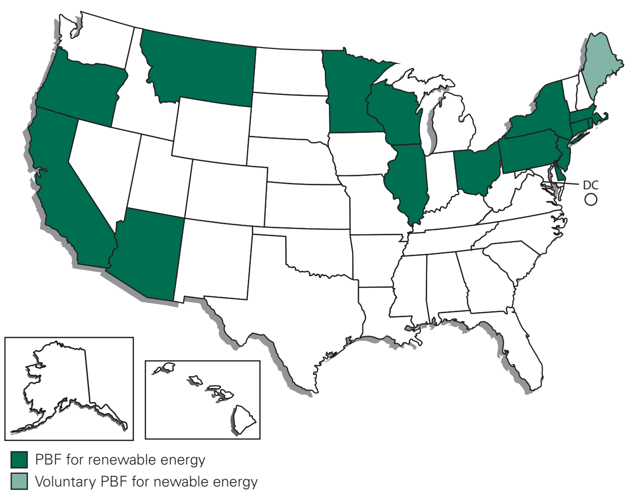
PBF-based clean energy funds offer the following benefits:

- *Provide a Cohesive Strategy "Under One Roof."* Combining a range of clean energy programs and funding within one organization allows for a cohesive strategy for addressing the range of clean energy market issues.
- *Tailored to a State's Needs.* State clean energy funds provide flexibility in the types of incentives and programs that states can offer and can be customized to the state's goals, natural resources, and industry presence (e.g., industries that are well established in a state, such as wind or biomass).
- *Support Long-Term Goals.* While policies such as renewable portfolio standards (RPS) are generally aimed at jump-starting markets for commercially ready technologies, clean energy funds have been designed to fund options with benefits that accrue over the long term. These longer-term programs, such as technology research, development, and demonstration programs, require a longer time frame (10 or more years) than is typically allowed by other approaches. In addition, these funds can be designed to improve the state economy by accelerating the development and deployment of technologies focused by in-state businesses. (See, for example, Section 5.1, *Renewable Portfolio Standards.)*
- *Complement Other Policies.* Because of their flexibility, state clean energy funds complement other state and federal policies, making those policies more effective. For example, PBFs are used by state energy programs to lower clean energy equipment costs by helping to ramp up volume, address key market barriers, and provide consumer education and outreach to increase the effectiveness and use of federal tax incentives, state RPS, and improved interconnection and net metering standards. In addition, PBFs can be used to support the successful implementation of other clean energy policies. For example, in California PBFs are used to pay the incremental cost for utility RPS compliance.

States That Use PBFs for Clean Energy Supply

As of early 2005, 16 states had established clean energy funds to promote renewable energy: Arizona, California, Connecticut, Delaware, Illinois, Massachusetts, Maine (voluntary), Minnesota,

Figure 5.2.2: Map of State Renewable Energy Funds



Sources: DSIRE 2005, Navigant 2005.

Montana, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, and Wisconsin (UCS 2004, DSIRE 2005). (See Figures 5.2.1 and 5.2.2.)

Designing and Implementing an Effective Clean Energy Fund

States consider a variety of key issues when designing PBFs directed at expanding the clean energy supply market. These issues include selecting an organizational structure to administer PBFs, protecting funding from being diverted for other uses, considering the importance of technology stages when designing PBF programs, and assessing the interaction of clean energy funds with state and federal policies.

Participants

Many states encourage the participation of a variety of stakeholders, including trade associations, equipment manufacturers, utilities, project developers, and leading environmental groups. For example, the consensus between stakeholders in Massachusetts over a clean energy fund resulting from electric utility restructuring is described in the Massachusetts Renewable Energy Collaborative (1997).

Administration

PBFs are typically established by state legislatures, and the bill(s) may provide varying levels of specificity for selecting an administrator for the PBF. Selecting the appropriate administrative organization for a clean energy fund is an important step. The role of the fund administrator is essential for the review of fund dispersal to ensure that each investment is valuable and represents the public interest. States have employed several organizational models for administering clean energy funds, including state energy offices, quasi-public agencies, public regulatory agencies, nonprofit organizations, and utilities. Many experts feel that no one model has proven more successful or effective than another.

States have chosen different models based on their goals and situations. Although utilities often manage PBFs used to support energy efficiency programs, utilities typically do not administer PBFs for renewable energy (a notable exception occurs in Arizona, where state renewable energy funds are managed by utilities). States have found that ensuring that a fund administrator has access to adequate staffing with appropriate expertise is more important than the administrative structure.

Examples of different administrative approaches include:

- *Massachusetts* chose the Massachusetts Technology Collaborative (MTC) to administer its clean energy funds. One of the main goals of the fund is to create a clean energy industry, and these goals are consistent with the MTC's charter, which is to foster high-tech industry "clusters" in Massachusetts (Commonwealth of Massachusetts 1997).
- *Connecticut* chose to administer its Clean Energy Fund through Connecticut Innovations Incorporated (CII), a quasi-public state agency charged with expanding Connecticut's entrepreneurial and technology economy. CII's experience in building a vibrant technology community in Connecticut fit well with the challenges of developing a clean energy industry and market.

Approach

States use a variety of approaches, based on their specific objectives, for using clean energy funds to support renewable energy market development. Some of these approaches are described below.

- *Investment Model.* Under this approach, loans and equity investments are used to support clean energy companies and projects. In many cases, renewable energy businesses find it difficult to obtain financing since traditional financial markets may be hesitant to invest in clean energy. The rationale behind having the state provide initial investment is to bring the renewable energy businesses and the traditional financial markets to a point where investment in renewable energy businesses is sustainable under its own power. (An example is the Connecticut Clean Energy Fund [CEF 2005].)
- *Project Development Model.* This approach uses financial incentives, such as production incentives and grants and/or rebates, to directly subsidize clean energy project installation. These funds typically are put in place to help renewable energy be more competitive in the short-term by offsetting or lowering the initial capital cost or by offsetting the higher ongoing cost of generation. The rationale behind these incentives is that increased market adoption of renewable energy technologies will ultimately drive down the cost of these technologies to a point where, without incentives, they can compete with traditional generation. (Examples include California's Renewable Resource Trust Fund [CEC 2005] and New Jersey's Clean Energy Program [NJCEP 2005].)
- *Industry Development Model.* With this approach, states use business development grants, marketing support programs, research and development grants, resource assessments, technical assistance, consumer education, and demonstration projects to support clean energy projects. The rationale behind these programs is that they will facilitate market transformation by building consumer awareness and demand, supporting the development of a qualified service infrastructure, and investing in technological advancement. (Examples include Wisconsin's Public Benefit Fund [State of Wisconsin 2005] and New Jersey's Clean Energy Program [NJCEP 2005].)

Funding

Leading states have designed their clean energy funds to be generated from a set rate in the electricity tariff, thereby providing consistency in funding levels from year to year. The ability to carry forward excess annual contributions to a clean energy fund can be important, especially during the fund's initial years. This approach helps states obtain consistent funding levels and protect against the diversion of funding to other state needs (e.g., to meet general budget shortfalls). If funding is diverted from the PBF to another use, such as to the state general fund, it significantly harms the ability of the PBF program to be successful, particularly during the initial years of the program.

Technology Stages

State clean energy funds include a portfolio of program options to support both emerging and commercially competitive technologies. Determining both the stage of technology development and the kind of incentives needed to support each technology are important steps in designing a clean energy fund program.

- For *emerging technologies*, clean energy funds can be used to address a variety of technical, regulatory, and market challenges. For example, MTC, administrator of the Massachusetts Renewable Energy Trust (MRET), is exploring offshore wind power, which to date has yet to be established in the United States. In anticipation of stakeholder concerns for potential wildlife, safety, and aesthetic impacts, MTC has used clean energy funds to bring stakeholders together in a collaborative process to discuss these issues. This approach ensures that stakeholder concerns and issues are addressed early in the process to help obtain support for later implementation.
- For renewable energy technologies that are *technologically proven but relatively expensive* compared

to fossil fuel energy generation, PBF funds can provide economic incentives to help bridge the gap between what the market is willing to bear and current costs. Examples of widely used incentives are buy-downs (rebates) for photovoltaic (PV), small wind systems, and fuel cells. For example, CII, administrator of the Connecticut Clean Energy Fund (CCEF), uses commercial buy-down programs for fuel cells and solar PV to support residential, commercial, and industrial uses of these technologies.

- Clean energy funds can also be used to develop programs that provide noneconomic incentives, which can be critical to *clean energy market development*. For example, while tax incentives and buy-down money may be available to support PV and fuel cells, additional funding might be needed to stimulate the development of a qualified installer network and other key industry infrastructure crucial to the success of the technology. For example, through its Renewable Energy Economic Development (REED) Program, New Jersey provides incentives to renewable energy companies to expand their businesses (e.g., helping to support infrastructure development) (NJCEP 2004).
- For *mature technologies* that are already cost-competitive (e.g., wind power, CHP, and biomass power), states can use clean energy funds to address other market barriers. For example, in 2003, the MTC formed the Massachusetts Green Power Partnership to use PBF funds to add economic certainty to Renewable Energy Certificate (REC) markets. MTC is currently entering into contracts of up to 10 years for RECs from RPS-eligible projects, providing them with bankable, long-term revenue from an investment-grade entity.
- *Increased use of CHP* can also be fostered with funding from state clean energy funds. In 2004, the New Jersey Board of Public Utilities' Office of Clean Energy created a CHP incentive program and provided $5 million for CHP projects. The California Public Utilities Commission (CPUC) issued a decision in 2001 requiring the investor-owned utilities to provide self-generation incentives, which include CHP.[22] In New York, the New York State Energy Research and Development Authority (NYSERDA) manages the Distributed Generation (DG)/CHP Program, which offers incentives for CHP projects funded by PBFs. From 2000 to 2004, NYSERDA awarded $64 million under the program, with the goal of awarding $15 million/year. (Note that some of this funding is provided from PBFs focused on energy efficiency.)

Interaction with State and Federal Policies

The incentives and programs implemented by clean energy funds interact with state and federal policies in ways that may be important to the designers of a clean energy fund. For example:

- States have found that programs designed to support the overall energy and environmental goals of the state and work in concert with other state renewable energy initiatives, such as RPS and tax credits, are most effective.
- Programs are most successful when leveraging other funding sources without activating "double-dipping" clauses. Incentives for wind projects that also allow developers to continue to take advantage of federal incentives include the production tax credit (PTC) and five-year accelerated depreciation (Wiser et al. 2002a).
- States have found that the success of clean energy fund incentives can also depend on the existence of other state clean energy policies. For example, in some states, net metering eligibility and interconnection standards may need to be established or modified by the state Public Utility Commission (PUC) to encourage small-scale distributed generation. (For more information on net metering and interconnection, see Section 5.4, *Interconnection Standards*.)

22 CPUC incentive funding is $125 million a year, most of which goes to PV installations. For microturbines or internal combustion (IC) engines, the incentive funding does not require CHP.

State Examples

California

The California Energy Commission (CEC), in coordination with the CPUC, manages clean energy funding in California. The California PBF, established in 1998, generates more than $135 million per year for clean energy. The program has four primary components:

- *Existing Renewable Resources*, which supports market competition among in-state existing renewable electricity facilities through varying incentives. Eligible existing renewable energy facilities are primarily supported through a cents/kWh payment.
- *New Renewable Resources*, which encourages new renewable electricity generation projects through fixed production incentives. Incentives are provided on a cents/kWh payment.
- *Emerging Renewable Resources*, which stimulates renewable energy and CHP[23] market growth by providing rebates to purchasers of onsite clean energy generation while encouraging market expansion (primarily incentives for capacity installed, on a dollar-per-watt basis).
- *Consumer Education*, which informs the public about the benefits and availability of renewable energy technologies through dissemination of general information and project descriptions.

Web sites:
http://www.energy.ca.gov/renewables/

http://www.cpuc.ca.gov/static/industry/electric/distributed+generation/

Connecticut

The CCEF is managed by a quasi-government investment organization called CII. CCEF receives about $20 million annually from PBFs. Since its inception in 1998 through September 2004, CCEF has invested a total of $52.8 million in renewable energy development. The program has three components:

- *Installed Capacity Program*, which supports long-term contracts for clean energy projects and incentive programs for host supply or onsite installations of clean DG projects.
- *Technology Demonstration Program*, which supports the demonstration of new clean energy technologies and innovative applications, while also providing infrastructure support to the emerging clean energy industry.
- *Public Awareness and Education Programs*, which support local clean energy campaigns to influence the buying behavior of electricity customers so that they voluntarily support clean energy.

Web site:
http://www.ctcleanenergy.com/

Massachusetts

MRET is managed by MTC, an independent economic development agency focused on expanding the renewable energy sector and Massachusetts' innovation economy. The State Division of Energy Resources provides oversight and planning assistance. A total of $150 million over a five-year period is earmarked for renewable energy. MTC's approach is to first identify barriers to renewable energy growth in Massachusetts, then leverage additional funds from other sources, including private companies and nonprofits. MTC's goals include maximizing public benefit by creating new high-tech jobs and producing clean energy. The MRET includes four program areas:

- Clean Energy Program
- Green Buildings and Infrastructure Program
- Industry Support Program
- Policy Unit

Web site:
http://www.mtpc.org/renewableenergy/index.htm

New Jersey

New Jersey's clean energy initiative, administered by the New Jersey Board of Public Utilities (NJBPU), provides information and financial incentives and creates enabling regulations designed to help New Jersey residents, businesses, and communities reduce their energy use, lower costs, and protect the environment.

23 Limited to fuel cell CHP systems fueled with biogas.

New Jersey's Clean Energy Program has three components: residential programs, commercial and industrial programs, and renewable energy programs. CHP is funded as an efficiency measure through the commercial and industrial programs.

On July 27, 2004, the NJBPU approved a funding level of $5 million for the Office of Clean Energy's CHP Program. The program's goals are to increase energy efficiency, reduce overall system peak demand, and encourage the use of emerging technologies. The 2004 CHP Program funded a total of 23 projects that will generate in excess of 8 megawatts (MW) of power with system efficiencies of 60% or greater.

Furthermore, on December 22, 2004, the NJBPU established the Clean Energy Program (CEP) funding level at $745 million for the years 2005–2008. Of that total, renewable energy programs will receive a total of $273 million, making New Jersey home of one of the most aggressive renewable energy programs in the country. In 2004, the Customer Onsite Renewable Energy Program provided $12 million in rebates for 280 PV projects, adding more than 2 MW of new capacity.

In addition, New Jersey takes a comprehensive approach to ensure that all the different programs and policies intended to support clean energy are in place and work together (e.g., RPS with solar set-aside, net metering, interconnection standards).

Web sites:
http://www.bpu.state.nj.us

http://www.njcleanenergy.com/html/Combined/combined.html

http://www.njcep.com/srec

New York

NYSERDA, a public benefit corporation created in 1975 by the New York State Legislature, administers the New York Energy $mart program. This program is designed to support certain public benefit programs during the transition to a more competitive electricity market. Some 2,700 projects in 40 programs are funded by a charge on the electricity transmitted and distributed by the state's investor-owned utilities. The New York Energy $mart program provides energy efficiency services, research and development, and environmental protection activities.

Among other things, the Energy $mart program administers the New York Energy $mart Loan Fund program, which provides an interest rate reduction of up to 4% (400 basis points) off a participating lender's normal loan interest rate for a term up to 10 years on loans for certain energy efficiency improvements and/or renewable technologies.

In addition, since 2001, NYSERDA has administered other programs for energy efficiency and renewable energy. These include the DG/CHP Program, which has approved 83 DG/CHP systems for funding, representing 90 MW of peak demand reduction.

Web site:
http://www.nyserda.org

Ohio

Ohio's 1999 electric restructuring law created the Energy Loan Fund (ELF) and Universal Service Board. The ELF will collect $100 million over 10 years to provide low-interest loans or loan guarantees for energy efficiency improvements undertaken at residential, government, educational, small commercial, small industrial, and agricultural facilities. Renewable energy projects and public education efforts are also eligible for loans through ELF. The Ohio Department of Development's Office of Energy Efficiency (OEE) operates this fund. CHP systems up to 25 MW for commercial, institutional, and industrial applications are eligible for grants and loans under this program.

Web site:
http://www.odod.state.oh.us/cdd/oee/energy_loan_fund.htm

What States Can Do

Action Steps for States

States have chosen from a variety of approaches and eligible technologies in developing their clean energy funds. The best practices common among these states have been explored above. This section describes suggested action steps states can take to help ensure these best practices are implemented.

It is important for states that want to include CHP in their clean energy portfolios to comprehensively promote its benefits. For example, identifying CHP as both a clean source of energy and a source of significant energy savings and efficiency provides additional flexibility in including CHP in PBF programs and communicating the program to the public.

States That Have an Existing Clean Energy Fund

A top priority after establishing a clean energy fund is to identify and mitigate issues that might adversely affect the program's success. Demonstrating that the desired benefits are being achieved is essential for continued funding and support for the program. States can:

- Develop and monitor progress against clear targets for renewable energy and CHP development and related goals, such as green power participation rates, infrastructure development (e.g., MW of new capacity), and consumer awareness. Often, these targets are related to state goals.
- If necessary, shift fund priorities and develop new or modified programs in response to changes in markets or technologies (Wiser et al. 2002b).

States That Do Not Have an Existing Clean Energy Fund

Broad political and public support is a prerequisite to establishing a clean energy fund. After establishing general support for goals, a key step is to facilitate discussion and negotiation among key stakeholders toward developing an appropriate clean energy fund design.

- Ascertain the level of general interest and support for renewable energy and CHP in the state. If awareness is low, consider performing an analysis followed by an educational campaign to raise awareness of the environmental and economic benefits of accelerating the development of clean energy supply. For example, SmartPower has been working in numerous states to raise awareness of clean energy through public education campaigns (SmartPower 2005).
- Establish a working group of interested stakeholders to consider design issues and develop recommendations toward a clean energy fund. Work with the state legislature and PUC, as necessary, to develop model language and address ratemaking issues for raising, distributing, and administering the fund. Develop draft legislation for consideration by the state legislature, if legislation is required to implement a clean energy fund. In addition, if necessary, work with the PUC to establish the ratemaking process for creating the SBC.

Related Actions

- Consider additional policies or regulations that will help make a clean energy fund successful. For example, consider net metering and interconnection standards that are favorable to renewable energy and CHP development. For more information on these policies, see Section 5.4, *Interconnection Standards*.
- Publicize success stories and goals that have been reached. Make sure that state officials, office holders, and the public are aware that the clean energy fund is working and achieving the desired results.
- Develop a stakeholder communication process. A majority of clean energy funds were established through legislation after a robust stakeholder process that included input from utilities, PUCs, energy users, equipment manufacturers, project developers, state energy offices, and clean energy advocates. A stakeholder process is crucial to ensuring that market and project realities are considered in the design process.

On The Horizon

The *Guide to Action* focuses on established PBF policies that have proven to be successful in various states. Table 5.2.1 provides a brief description of emerging policies and innovative approaches, along with sources of additional information about these policies. To learn about additional policies on the horizon related to the other energy supply policies, see Appendix C, *Clean Energy Supply: Technologies, Markets, and Programs*.

Table 5.2.1: Emerging Policies and Innovative Approaches

Policy	Description	For More Information
Contractor and Equipment Certification	Some states require equipment and contractor certification for renewable energy installations that receive buy-down or state financial incentives. These standards ensure that high-quality products and services are provided to customers.	The North American Board of Certified Energy Practitioners (NABCEP) works with renewable energy and energy efficiency industries, professionals, and stakeholders to develop and implement quality credentialing and certification programs for practitioners. http://www.nabcep.org In New York, NYSERDA's PV or Solar Electric Incentive Program provides cash incentives for the installation of small PV or solar-electric systems. The cash incentives are only available for PV systems purchased through an eligible installer. http://www.powernaturally.org/Programs/Solar/incentives.asp?i=1
Standard REC Trading/Tracking Systems	A few state renewable energy programs currently have Web-based tracking systems for DG and/or assigning RECs based on this generation. These systems enable DG systems to participate in REC markets.	New Jersey established a separate REC trading system for solar PV. http://www.njcep.com/srec/
Mandated Long-Term Contracts for Renewables	This policy allows utilities in deregulated markets to sign long-term contracts with renewable energy generators. This would provide generators with the long-term certainty they need to get their projects financed.	The Colorado referendum that created the RPS requires a 20-year purchase for projects eligible to satisfy the RPS. http://www.dora.state.co.us/puc/rulemaking/Amendment37.htm A legislative act in Connecticut requires distribution companies to sign long-term Power Purchase Agreements for no less than 10 years for clean energy at a wholesale market price plus up to $0.055 per kWh for the REC. http://www.ctcleanenergy.com/investment/MarketSupplyInitiative.html
Integrating PUC goals into PBF Program Design (i.e., "Cross-Walking")	This policy encourages the use of PBFs not only to support energy efficiency and renewable energy but also to help PUCs and utilities reach their goals, such as increased reliability, congestion relief, and permanent peak reduction.	New England Demand Response Initiative. http://nedri.raabassociates.org/index.asp In Massachusetts, annual peak demand reductions from energy efficiency and PBF-funded load management ranged from 98 to 135 MW in 1998, 1999, and 2000. Cumulative reductions from these programs reached 700 MW (7.2% of peak) as of 2000. http://eetd.lbl.gov/EA/EMP/reports/PUB5482.pdf

Source: Compiled by EPA based on multiple sources.

Information Resources

Federal Resources

Title/Description	URL Address
The U.S. Environmental Protection Agency's (EPA's) CHP Partnership is a voluntary program that seeks to reduce the environmental impact of energy generation by promoting the use of CHP. The Partnership helps states identify opportunities to encourage energy efficiency through CHP, and can provide additional assistance, including information on CHP incentives and program design.	http://www.epa.gov/chp/
The EPA Green Power Partnership is a voluntary Partnership between EPA and organizations that are interested in buying green power. Through this program, the EPA supports organizations that are buying or planning to buy green power.	http://www.epa.gov/greenpower/

General Articles and Resources About Clean Energy Funds

Title/Description	URL Address
Case Studies of State Support for Renewable Energy. This site contains a set of articles pertaining to different aspects of clean energy funds authored by staff at Lawrence Berkeley National Laboratories (LBNL).	http://eetd.lbl.gov/ea/EMS/cases/
Clean Energy States Alliance (CESA). Twelve states have established funds to promote renewable energy and clean energy technologies. CESA is a nonprofit organization that provides information and technical services to these funds and works with them to build and expand clean energy markets in the United States. The CESA Web site includes links to all state clean energy funds and related state agencies.	http://www.cleanenergystates.org/
The Database of State Incentives for Renewable Energy (DSIRE). This database is a comprehensive source of information on state, local, utility, and selected federal incentives that promote renewable energy.	http://www.dsireusa.org/
SmartPower Web Site: Marketing Resources. SmartPower has been working in numerous states to raise the awareness of clean energy through public education campaigns.	http://www.smartpower.org/clean_energy_marketing.htm
Union of Concerned Scientists. This Web site contains articles and fact sheets by staff at the Union of Concerned Scientists on clean energy funds and PBFs for renewable energy. New articles and other information are added to the Web site continually.	http://www.ucsusa.org/clean_energy/

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Commonwealth of Massachusetts. 1997. Chapter 164 of the Acts of 1997. An act regarding restructuring the electric utility industry in the Commonwealth, regulating the provision of electricity and other services, and promoting enhanced consumer protections therein. Approved November 25.	http://www.mass.gov/legis/laws/seslaw97/sl970164.htm
DSIRE. 2005. DSIRE Web site. Contains information on state PBFs.	http://www.dsireusa.org/index.cfm?&CurrentPageID=2
Massachusetts Renewable Energy Collaborative. 1997. Consensus Report to the Legislature on the Proposed Renewable Energy Fund. July 1.	http://www.raabassociates.org/Articles/Renewable_Fund_Final.doc
Navigant. 2005. Company intelligence. Navigant Consulting Inc. Also see Katofsky, R. and L. Frantzis. 2005. Financing renewables in competitive electricity markets. Power Engineering. March 1.	http://www.navigantconsulting.com/A559B1/navigantnew.nsf/vGNCNTByDocKey/PPA91045514813/$FILE/Financing%20Renewables%20in%20Competitve%20Electricity%20Markets_Power%20Engineering_March%202005.pdf
NJCEP. 2004. New Jersey Clean Energy Program: Incentives, Regulation, and Services Designed to Transform Energy Markets in New Jersey. October 4. 9th National Green Power Marketing Conference, Scott Hunter, NJBPU, Office of Clean Energy.	http://www.eere.energy.gov/greenpower/conference/9gpmc04/hunter.pdf
NJCEP. 2005. Financial Incentives to “Get with the Program.” NJCEP Web site. Accessed July 2005.	http://www.njcep.com/html/2_incent.html
SmartPower. 2005. SmartPower Web Site: Marketing Resources. SmartPower has been working in numerous states to raise the awareness of clean energy through public education campaigns.	http://www.smartpower.org/clean_energy_marketing.htm
State of Wisconsin. 2005. Focus on Energy. Renewable Energy. Wisconsin’s Focus on Energy Web site. Accessed July 2005.	http://www.focusonenergy.com/
UCS. 2004. Table of State Renewable Energy Funds. Union of Concerned Scientists.	http://www.ucsusa.org/clean_energy/clean_energy_policies/clean-energy-policies-and-proposals.html (PDF Link: State Renewable Energy Funds)
Wiser, R, M. Bolinger, and T. Gagliano. 2002a. Analyzing the Interaction between State Tax Incentives and the Federal Production Tax Credit for Wind Power. LBNL-51465. Environmental Energy Technologies Division, LBNL, Department of Energy, Berkeley, CA. September.	http://eetd.lbl.gov/ea/EMS/reports/51465.pdf
Wiser, R., M. Bolinger, L. Milford, K. Porter, and R. Clark. 2002b. Innovation, Renewable Energy, and State Investment: Case Studies of Leading Clean Energy Funds. LBNL-51493. Environmental Energy Technologies Division, LBNL and The Clean Energy Group. September.	http://eetd.lbl.gov/ea/EMS/reports/51493.pdf

5.3 Output-Based Environmental Regulations to Support Clean Energy Supply

Policy Description and Objective

Description

Output-based environmental regulations relate emissions to the productive output of a process. The goal of output-based environmental regulations is to encourage the use of fuel conversion efficiency and renewable energy as air pollution control measures. While output-based emission limits have been used for years in regulating some industrial processes, their use is only recently evolving for electricity and steam generation. Output-based regulations can be an important tool for promoting an array of innovative energy technologies that will help achieve national environmental and energy goals by reducing fuel use.

Most environmental regulations for power generators and boilers have historically established emission limits based on heat input or exhaust concentration: that is, they measure emissions in pounds per million British thermal units (lb/MMBtu) of heat input or in parts per million (ppm) of pollutant in the exhaust stream. These traditional input-based limits do not account for the pollution prevention benefits of process efficiency in ways that encourage the application of more efficient generation approaches. For example, a facility that installs an energy efficient technology emits less, because less fuel is burned. But with an input-based emission limit, the reduced emissions from improved energy efficiency are not counted toward compliance. By not accounting for these emission reductions, input-based emission limits can be a barrier to adopting energy efficiency improvements.

Output-based emission limits are particularly important for promoting the significant energy and environmental benefits of combined heat and power (CHP). CHP units produce both electrical and thermal output. Output-based limits can be designed to explicitly account for both types of output in the compliance computation. Traditional input-based limits, on the other hand, can present a barrier to selecting CHP technologies, because they do not account for the emission reductions achieved through increased generation efficiency.

States utilize output-based environmental regulations to encourage efficient energy generation by leveling the playing field for fuel conversion efficiency and renewable energy as air pollution control measures. Historically, environmental regulations have been input-based, which does not account for the pollution prevention benefits of process efficiency, which encourages the use of more efficient generation approaches.

To encourage more efficient energy generation, states have begun to design and implement output-based environmental regulations. An output-based emission limit is expressed as emissions per unit of useful energy output (i.e., electricity, thermal energy, or shaft power). The units of measure can vary depending on the type of energy output and the combustion source. For electricity generation, the unit of measure is mass of emissions per megawatt-hour (lb/MWh).

Output-based emission limits do not favor any particular technology and do not increase emissions. Output-based regulations simply level the playing field by establishing performance criteria and allowing energy efficiency and renewable energy to compete on an equal footing with any other method of reducing emissions (e.g., combustion controls and add-on controls).

Objective

The key objective is to encourage more efficient energy generation by designing environmental regulations that allow energy efficiency to compete as an air pollution control measure. Emission standards that account for the emission reduction benefits of energy efficiency, and specifically the efficiency benefits of CHP, will make it more attractive for facilities to permit and install clean energy technologies.

Output-based approaches also can be designed into cap and trade programs to encourage non-emitting end-use energy efficiency and renewable energy projects.

An output-based emission regulation can reduce compliance costs because it gives the plant operator greater flexibility in reducing emissions. A facility operator can comply by installing emission control equipment, using a more energy efficient process, or using a combination of the two. Regulating the emissions produced per unit of output has value for equipment designers and operators because it gives them additional opportunities to reduce emissions through more efficient fuel combustion, more efficient cooling towers, more efficient generators, and other process improvements that can increase plant efficiency.

Example of Cost Flexibility Allowed by an Output-Based Emission Standard

Consider a planned new or repowered coal-fired utility plant with an estimated uncontrolled nitrogen oxide (NO_x) emissions rate of 0.35 lb/MMBtu heat input. To comply with an input-based emission standard of 0.13 lb/MMBtu heat input, the plant operator would have to install emission control technology to reduce NO_x emissions by more than 60%. On the other hand, if the plant were subject to an equivalent output-based emission standard of 1.3 lb/MWh, then the plant operator would have the option of considering alternative control strategies by varying both the operating efficiency of the plant and the efficiency of the emission control system (Table 5.3.1). This output-based format allows the plant operator to determine the most cost-effective way to reduce NO_x emissions and provides an incentive to reduce fuel combustion. The total annual emissions are the same in either case.

Table 5.3.1: Design Flexibility Offered by Output-Based Standards

Plant Efficiency (%)	Emission Standard (lb/MWh)	Required Control Device Efficiency (%)
34	1.3	60
40	1.3	55
44	1.3	48

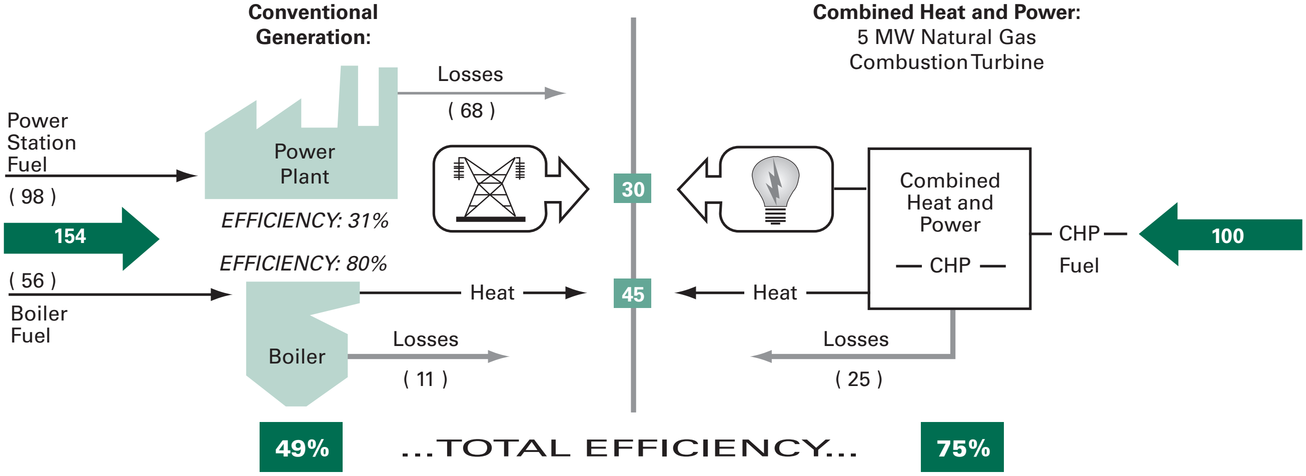
Source: EPA 2004.

Benefits

Output-based environmental regulations level the playing field and encourage pollution prevention and energy efficiency. The primary benefits of using more efficient combustion technologies and renewable energy include:

- *Multi-Pollutant Emission Reductions.* The use of efficiency as a pollution control measure results in multi-pollutant emission reductions. For example, to comply with a rule for NO_x, a source that increases fuel conversion efficiency will reduce emissions of all other pollutants, including sulfur dioxide (SO_2), particulate matter, hazardous air pollutants, as well as unregulated emissions such as carbon dioxide (CO_2).
- *Multimedia Environmental Reductions.* By encouraging reduced fuel use, output-based environmental regulations reduce air, water, and solid waste impacts from the production, processing, transportation, and combustion of fossil fuels.
- *Reduced Fossil Fuel Use.* Encouraging energy efficiency and renewable energy sources will reduce stress on today's energy systems and reduce the demand for imported fossil fuels.
- *Technology Innovation.* Encouraging more efficient energy generation can advance the use of innovative technologies, such as CHP. Figure 5.3.1 illustrates how CHP can save energy compared to the conventional practice of separate generation of heat and power. CHP offers a combined fuel conversion efficiency of 75% compared to 45% for the conventional system while providing the same thermal and electric service. As a result, the CHP system emits only 17 tons of NO_x per year while the conventional system emits 45 tons per year.

Figure 5.3.1: CHP System Efficiency



Source: EPA 2004.

- *Compliance Flexibility.* Allowing the use of energy efficiency as part of an emission control strategy provides regulated sources with an additional compliance option. Under an output-based environmental regulation, sources would have the option of varying both the efficiency of the process and the efficiency of the emission control system. This flexibility allows the plant operator to determine the most cost-effective way to reduce emissions, while providing an incentive to burn less fuel. Input- or concentration-based regulations do not provide this option.

States That Have Developed Output-Based Regulations

Several states have been at the forefront of adopting output-based environmental regulations in general and, in particular, developing rules that account for the efficiency benefits of CHP. Programs adopted by these states include:

- Conventional emission limits using an output format.
- Special regulations for small distributed generators (DG) that are output-based.
- Output-based allowance allocation methods in a cap and trade program.
- Output-based allowance allocation set-asides for energy efficiency and renewable energy.
- Multi-pollutant emission regulations using an output-based format.

A summary of state output-based environmental regulations programs is presented in Table 5.3.2.

Designing an Effective Output-Based Environmental Regulations Program

Key elements that are involved in designing an effective output-based environmental regulations program include participants, applicable programs, interaction with other state and federal policies, and barriers to developing output-based environmental regulations.

The most common use of output-based regulations is for emission limits. To design an output-based limit, states make several decisions about the format of the rule. Making these decisions involves tradeoffs between the degree to which the rule accounts for the benefits of energy efficiency, the complexity of the rule, and the ease of measuring compliance.

Table 5.3.2: State Output-Based Regulations

State	Rule Type
California	Small DG Rule[a]
Connecticut	Allowance Allocation/trading Small DG Rule[a]
Delaware	Allowance Allocation/trading Small DG Rule[a]
Indiana	Allowance Allocation/set-asides
Maine	Small DG Rule
Maryland	Allowance Allocation/set-asides
Massachusetts	Allowance Allocation/trading[a] Small DG Rule Multi-Pollutant Regulation Allowance Allocation/set-asides
New Hampshire	Multi-Pollutant Regulation
New Jersey	Allowance Allocation/trading Allowance Allocation/set-asides
New York	Small DG Rule Allowance Allocation/set-asides
Ohio	Allowance Allocation/set-asides
Texas	Conventional NO_x Limits Small DG Rule[1]

[a] Includes recognition of CHP through inclusion of a thermal credit.

Source: Compiled by EPA based on multiple sources.

The general steps for designing an output-based emission standard are:

- *Develop the Output-Based Emission Limit*. The method used to develop this limit depends on whether emissions and energy output data that were measured simultaneously are available. If not, states can develop output-based emission limits by converting input-based emissions data or existing emission limits to an output-based equivalent using unit conversions and a benchmark energy efficiency.
- *Specify a Gross or Net Energy Output Format*. Net energy output will more comprehensively account for energy efficiency, but can increase the complexity of compliance monitoring requirements.
- *Specify Compliance Measurement Methods*. Output-based rules require methods for monitoring electrical, thermal, and mechanical outputs. These outputs are already monitored at most facilities for commercial purposes, and the methods are readily available.
- *Specify How to Calculate Emission Rates for CHP Units*. To account for the pollution prevention benefits of CHP, output-based regulations must specify a method to account for both the thermal and electric output of the CHP process (in this document, we refer to this as "recognizing" CHP). States have used several approaches to recognize CHP. These approaches are described in more detail in The U.S. Environmental Protection Agency's (EPA's) *Output-Based Regulations: A Handbook for Air Regulators* (EPA 2004). Each approach has policy and implementation tradeoffs, but they all provide a more appropriate framework for regulating CHP emissions than do conventional emission limit formats.

Participants

- *State Environmental Agencies.* The state environmental agency is responsible for formulating and administering state air regulations.
- *State Energy Offices and Public Utility Commissions (PUCs).* These organizations can play an active role in encouraging the use of output-based environmental regulations. Both types of organizations typically have an interest in promoting efficient and clean energy generation and are looking for policies that can promote such technologies. They often have a good understanding of the value of efficiency in the generating sector and can assist the process by analyzing potential energy and economic benefits that the state could achieve by using output-based environmental regulations.
- *State Economic Development Agencies*. These agencies may also have an interest in output-based environmental regulations due to their potential to encourage lower cost and more reliable sources of energy for new industry. Output-based environmental regulations might also simplify environmental permitting for clean, efficient facilities, providing an advantage for economic development in the state.

- *Regulated and Nonregulated Stakeholders.* Stakeholders often play a role in developing and promoting output-based environmental regulations. Energy users, CHP and DG equipment manufacturers, project developers, and trade associations representing these interests may provide relevant information and comments throughout the regulatory development and implementation process.
- *State Legislators.* In some cases, state legislators may play a role in promoting output-based environmental regulations. Legislators can be proponents of efficiency and clean technology and can provide support for development of output-based environmental regulations as a means of meeting state efficiency and clean air goals.

Applicable Programs

Output-based concepts can be applied to a variety of air regulatory programs, including:

- *Conventional Emission Limits, Such as Reasonably Available Control Technology (RACT), National Emission Standards for Hazardous Air Pollutants (NESHAP), and New Source Performance Standards (NSPS).* The Ozone Transport Commission (OTC) has used an output-based format for "beyond-RACT" NO_x limits. EPA has used an output-based approach with recognition of CHP for the NSPS for NO_x from utility boilers, the NSPS for mercury from coal-fired utility boilers, and the NESHAP for combustion turbines.
- *Emission Limits for Small DG and CHP.* Most states that have recently promulgated emission limits for DG are using output-based environmental regulations. These states include California, Texas, Connecticut, Massachusetts, and Maine. Delaware, Rhode Island, and New York are currently developing output-based environmental regulations. All of these states, except Massachusetts and New York, recognize CHP by including a thermal credit in their regulations. Massachusetts and New York currently are considering how to recognize CHP. These are standalone efforts in response to developing markets for DG.
- *Allowance Allocation in Emission Trading Programs.* Allowance allocation is an important component in emission cap and trade programs for electric utilities. Allowance allocations are most commonly based on either heat input or energy output. Allocation based on heat input gives more allowances to less efficient units, and allocation based on energy output gives more allowances to more efficient units. An updating allocation system (where allowances are reallocated in the future) using an output basis provides an ongoing incentive for improving energy efficiency. Connecticut and New Jersey use output-based allocation in their NO_x trading rules. Massachusetts uses an output-based allocation that includes the thermal energy from CHP.
- *Allowance Allocation Set-Asides for Energy Efficiency and Renewable Energy.* In addition to allocating allowances to regulated sources, a cap and trade program can "set aside" a portion of its NO_x allowances for allocation to energy efficiency, renewable energy, and CHP projects that are not regulated under the cap and trade program. These unregulated units can sell the allowances to regulated units to generate additional revenue. States with set-aside programs include Indiana, Maryland, Massachusetts, New York, New Jersey, and Ohio. Connecticut is currently developing a set-aside rule.
- *Multi-Pollutant Programs*. Several states have adopted multi-pollutant emission limits for power generators. Some include emission trading, while others are similar to conventional emission rate limits. Massachusetts and New Hampshire have established such programs using output-based environmental regulations, although neither currently includes CHP.

Interaction with Federal Policies

Several federal programs have adopted output-based regulations with recognition of CHP (see *Examples of Legislation and Program Proposals*, in *Information Resources* on page 5-41). These programs include:

- NSPS for NO_x from electric utility boilers and the proposed combustion turbines both apply output-based limits with recognition of CHP through the treatment of a thermal credit. The boiler NSPS was one of the first such rules and helped set an example for other regulations. The most recently proposed NSPS revisions expand the use of output-based environmental regulations to other pollutants and improve the treatment of thermal output from CHP.

- Emission limits in state implementation plans (SIPs) can be in expressed in any format as long as the plan demonstrates compliance with federal air quality standards.
- The new EPA cap and trade programs (Clean Air Interstate Rule for ozone and fine particulate matter and the Clean Air Mercury Rule) allow states to determine the method for allocating allowances. The EPA model rules include examples of output-based allocation, including methods to include CHP units. These model rules can be adopted by states "as is," which would be a benefit to CHP.

Interaction with State Policies

The use of output-based environmental regulations to encourage CHP can be coordinated with other state programs, including:

- State emission disclosure programs for electricity that typically use an output-based format (lb/MWh). This is an indication of the usefulness of the output-based approach to accurately relate emissions to useful output.
- Other state policies that are important in encouraging efficiency and CHP development include grid interconnection standards, electricity and gas ratemaking, and financial incentives for CHP developments.

Barriers to Developing Output-Based Environmental Regulations

For power and steam applications, an output-based regulation is a change from historical regulatory practice and can create uncertainties for implementation. At this time, however, the use of output-based environmental regulations is growing, and there has been sufficient experience with state and EPA rulemakings to provide successful examples for rule development and implementation.

One issue that has been raised in past rulemakings is the lack of simultaneously measured energy output and emission data upon which to base the emission limit. Where these data were not available, EPA and states developed output-based environmental regulations by converting input-based data or emission limits to an output-based format using units of measure conversions and a benchmark energy efficiency. The selection of a benchmark energy efficiency is an important policy decision, because processes with efficiency below the benchmark would have to control emissions to a greater degree than those that exceed the benchmark. This is especially true for regulation of existing sources, which have far fewer options to take advantage of efficiency. Application of output-based regulation to existing sources

Best Practices: Developing and Adopting an Output-Based Regulation

The best practices identified below will help states design effective output-based environmental regulations programs. These recommendations are based on the experiences of states that have implemented output-based environmental regulations to encourage CHP.

- Determine what types of DG and CHP technologies and applications might be affected and whether there are any specific technology issues that the regulation needs to address. Consult with the PUC, the independent system operator (ISO), and owners on operations of DG and CHP units to inform regulatory determinations.
- Gather/review available output-based emission data for regulated sources. Alternatively, convert available data to output-based format. Obtain information from equipment providers on technologies and emissions profiles, and capitalize on experience and work already conducted by other states.
- Evaluate alternative approaches to account for multiple outputs of CHP units. (See EPA's 2004 *Output-Based Regulations: A Handbook for Air Regulators* and other references in the *Information Resources* section on page 5-40).

requires special attention to the feasibility and cost of compliance options.

Other common issues include the feasibility of emission monitoring, compliance methods, and technology to measure process output (electricity and thermal output). However, all of these questions have been successfully addressed by states in their output-based rulemakings (see *State Examples* on page 5-39).

Program Implementation and Evaluation

The best practices states can use when implementing and evaluating output-based regulations are described below.

Administering Body

The state, local, or tribal environmental agency is almost always responsible for developing output-based environmental regulations.

Roles and Responsibilities of Implementing Organization

The state, local, or tribal environmental agency's responsibilities include:

- Identify and evaluate opportunities for the application of output-based environmental regulations.
- Gather information, develop goals for output-based environmental regulations, develop output-based environmental regulations, and establish appropriate output-based emission limits.
- Publicize and implement output-based environmental regulations. Train permit writers on new rules.
- Evaluate the value of output-based environmental regulations in encouraging efficiency, CHP, and emission reductions.

Evaluation

States can evaluate their overall air pollution regulatory program periodically to determine whether their regulations are structured to encourage energy efficiency, pollution prevention, and renewable resources. This evaluation helps identify new opportunities for using output-based environmental regulations to encourage energy efficiency through effective regulatory design.

Regulatory programs are routinely reviewed and revised, and occasionally new programs are mandated by state or federal legislation. For example, states are developing revised SIPs to achieve greater emission reductions to address problems of ozone, fine particulates, and regional haze. States can use this opportunity to evaluate the benefits of energy efficiency in attaining and maintaining air quality goals. States can identify the overall benefits of output-based

Best Practices: Implementing Output-Based Regulations

The best practices identified below will help states effectively implement their output-based environmental regulations programs. These recommendations are based on the experiences of states that have implemented output-based environmental regulations to encourage CHP.

- Start with internal education to ensure that state environmental regulators understand the benefits, principles, and mechanisms of output-based environmental regulations and CHP. Ensure that regulators understand why this change is good for the environment.
- Coordinate with other state agencies that can lend support. State energy offices, energy research and development offices, and economic development offices can provide valuable information on the energy benefits of output-based environmental regulations, efficiency, and CHP. Their perspective on the importance of energy efficiency and pollution prevention can help formulate policy.
- Apply output-based environmental regulations principles to new regulations, as appropriate.
- Publicize the new rules. Consider training permit writers on implementation of the new rules.

environmental regulations by assessing the affect of higher efficiency on energy savings, other emissions reduced, jobs created, and costs savings to utilities and consumers. It may be advantageous to engage state energy officials in this process to get additional perspective and insights into the energy implications of output-based environmental regulations.

State Examples

Connecticut

Connecticut has promulgated output-based environmental regulations for NO_x, particulate matter, carbon monoxide (CO), and CO_2 from small distributed generators (< 15 MW capacity), including CHP. The regulation is expressed in lb/MWh based on the Model Rule for DG developed by the Regulatory Assistance Project (RAP 2002). The regulation values the efficiency of CHP based on the emissions that are avoided by not having separate electric and thermal generation. Connecticut also allocates allowances based on energy output in their NO_x trading program.

Web site:
http://dep.state.ct.us/air2/regs/mainregs/sec42.pdf

Indiana

Indiana has created a set-aside of allowance allocations for energy efficiency and renewable energy in their NO_x trading program. Indiana allocates 1,103 tons of NO_x allowances each year for projects that reduce the consumption of electricity, reduce the consumption of energy other than electricity, or generate electricity using renewable energy. Highly efficient electricity generation projects for the predominant use of a single end user or highly efficient generation projects that replace or displace existing generation equipment are eligible to apply for NO_x allowances. Projects can involve combined cycle systems, CHP, microturbines, or fuel cells.

Web site:
http://www.in.gov/idem/air/standard/Sip/guide.pdf

Massachusetts

Massachusetts has used output-based environmental regulations in several important regulations. The Massachusetts NO_x cap and trade program employs useful output, including the thermal output of CHP, to allocate emission allowances to affected sources (generators > 25 MW). This approach provides a significant economic incentive for CHP within the emissions cap. Massachusetts also has a multi-pollutant emission regulation (NO_x, SO_2, mercury [Hg], CO_2) for existing power plants, which uses an output-based format for conventional emission limits.

Web site:
http://www.mass.gov/dep/bwp/daqc/files/728reg.pdf

Texas

In 2001, Texas promulgated a standard permit with output-based emission limits for small electric generators. The permit sets different NO_x limits (lb/MWh) based on facility size, location, and level of utilization. The compliance calculation accounts for the thermal output of CHP units by converting the measured steam output (British thermal unit, or Btu) to an equivalent electrical output (MWh). To qualify as a CHP unit, the heat recovered must represent a minimum of 20% of total energy output by the unit.

Web site:
http://www.tnrcc.state.tx.us/permitting/airperm/nsrpermits/files/segu_permitonly.pdf

What States Can Do

Output-based regulations with provisions to recognize the pollution prevention benefits of CHP are becoming more common in the development and implementation of environmental regulations. Where appropriate, states can investigate incorporating output-based environmental regulations into new regulations or amendments. The most important step is to integrate an evaluation of output-based environmental regulations into the routine review and implementation of environmental regulations. In this way, a state can promote energy efficiency through the structure of its air pollution regulatory program.

Information Resources

Federal Resources

Title/Description	URL Address
Developing and Updating Output-based NO_x Allowance Allocations. This EPA guidance document was the result of a 1999 stakeholder process to develop approaches to output-based allocation of emission trading allowances, including allocation to CHP facilities.	http://www.epa.gov/airmarkets/fednox/april00/finaloutputguidanc.pdf
The EPA CHP Partnership. This voluntary program seeks to reduce the environmental impact of energy generation by promoting the use of CHP. The Partnership helps states identify opportunities for policy developments (i.e., energy, environmental, and economic) to encourage energy efficiency through CHP. In 2006, the Partnership, in conjunction with the Northeast States for Coordinated Air Use Management (NESCAUM), is developing output-based environmental regulations training for state air regulators.	http://www.epa.gov/chp
Output-Based Regulations: A Handbook for Air Regulators. The EPA CHP Partnership has developed a handbook that explains the benefits of output-based emission limits, how to develop output-based environmental regulations, and the experience of several states in implementing output-based environmental regulations. This handbook is intended as a resource for air regulators in evaluating opportunities to adopt output-based environmental regulations and in writing regulations.	http://www.epa.gov/chp/pdf/output_rpt.pdf

Other Resources

Title/Description	URL Address
The Impact of Air Quality Regulations on Distributed Generation. National Renewable Energy Laboratory (NREL), Golden, CO. October. This report finds that current air quality regulatory practices are inhibiting the development of DG, either through a failure to recognize the environmental benefits offered by DG or by imposing requirements designed for larger systems that are not appropriate for DG systems.	http://www.nrel.gov/docs/fy03osti/31772.pdf
NESCAUM. This is an interstate association of air quality control divisions in the Northeast. The eight member states are comprised of the six New England States and New York and New Jersey. NESCAUM's purpose is to exchange technical information and promote cooperation and coordination of technical and policy issues regarding air quality control among the member states.	http://www.nescaum.org/
Regulatory Requirements Database for Small Electric Generators. This online database provides information on state environmental regulations for small generators and other types of regulations for small generators.	http://www.eea-inc.com/rrdb/DGRegProject/index.html

General Articles on Output-Based Regulation

Title/Description	URL Address
Analysis of Output-Based Allocation of Emission Trading Allowances. This report for the U.S. Combined Heat and Power Association (USCHPA) provides background on emission trading programs and the benefits of output-based allocation, with a particular focus on CHP.	http://uschpa.admgt.com/AllocationFinal.pdf

Examples of Legislation and Program Proposals

Following are examples of output-based approaches to different types of environmental regulation:

Example	Title/Description	URL Address
Allowance Allocation	Massachusetts uses useful output, including thermal energy from CHP, to allocate emission allowances in its NO_x trading program.	http://www.mass.gov/dep/bwp/daqc/files/728reg.pdf
	EPA has also included elements of output-based emission allocation approaches in its model trading rules for the Clean Air Interstate Rule (CAIR) and Clean Air Mercury Rule.	http://www.epa.gov/cair/pdfs/cair_final_reg.pdf http://www.epa.gov/mercuryrule/pdfs/camrfinal_regtext.pdf
	EPA has suggested model language for energy efficiency/renewable energy set-asides in NO_x emission trading programs.	http://www.epa.gov/ttn/oarpg/t1/memoranda/ereseerem_gd.pdf
Conventional Rate Limits	The OTC has developed output-based "beyond RACT" regulatory language for a variety of sources.	http://www.otcair.org/interest.asp?Fview=stationary#
	The federal NSPS for NO_x from electric utility boilers and the proposed NSPS for combustion turbines are structured as output-based environmental regulations. Each rule also contains compliance provisions for CHP. These regulations provide excellent examples of rule language and technical background documentation.	http://www.epa.gov/ttn/oarpg/t3pfpr.html
DG Regulations	Texas has an output-based standard permit for small electric generators with recognition of CHP.	http://www.tnrcc.state.tx.us/permitting/airperm/nsr_permits/files/segu_permitonly.pdf
	The RAP, with support from the U.S. Department of Energy (DOE), developed model rule language for regulation of small electric generators, including CHP.	http://www.raponline.org/ProjDocs/DREmsRul/Collfile/ModelEmissionsRule.pdf
	Connecticut has promulgated a rule using the RAP model rule approach.	http://dep.state.ct.us/air2/regs/mainregs/sec42.pdf

References

Title/Description	URL Address
EPA. 2004. Output-Based Regulations: A Handbook for Air Regulators. Produced in a joint effort between Energy Supply and Industry Branch, Green Power Partnership and CHP Partnership. August 2004.	http://www.epa.gov/chp/pdf/output_rpt.pdf
RAP. 2002. Model Regulations for the Output of Specified Air Emissions from Smaller-scale Electric Generation Resources Model Rule and Supporting Documentation. RAP. October 15.	http://www.raponline.org/ProjDocs/DREmsRul/Collfile/ModelEmissionsRule.pdf

5.4 Interconnection Standards

Policy Description and Objective

Summary

Standard interconnection rules for distributed generation (DG) systems (renewable energy and combined heat and power [CHP]) are a relatively recent policy innovation used by states to accelerate the development of clean energy supply. CHP is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source by recovering the waste heat for use in another beneficial purpose. Customer-owned DG systems are typically connected in parallel to the electric utility grid and are designed to provide some or all of the onsite electricity needs. In some cases, excess power is sold to the utility company.

Standard interconnection rules establish uniform processes and technical requirements that apply to utilities within the state. In some states, municipally owned systems or electric cooperatives may be exempt from rules approved by the state regulators. Standard interconnection rules typically address the application process and the technical interconnect requirements for small DG projects of a specified type and size.

Customers seeking to interconnect DG systems to the utility grid must meet the procedural and technical requirements of the local utility company. These requirements address such important issues as grid stability and worker and public safety. With the approval of regulators, utilities establish the conditions that customers seeking to connect DG systems to the grid must meet. These conditions include safeguards, grid upgrades, operating restrictions, and application procedures that may create barriers for some DG projects, particularly smaller systems. Smaller-scale DG systems are often subject to the same, frequently lengthy, interconnection procedures as larger systems even though their system impact is likely to be significantly less. If interconnection procedures are overly expensive in proportion to the size of the project, they can overwhelm project costs to the point of making clean DG uneconomical.

It is for these and other reasons that states are increasingly developing and promoting standardized interconnection requirements and rules for DG. In addition, some states use net metering rules to govern interconnection of smaller DG systems. Net metering is a method of crediting customers for electricity that they generate on site in excess of their own electricity consumption. It allows smaller DG owners to offset power that they obtain from the grid with excess power that they can supply through their grid connection.

Standard interconnection is a critical component of promoting clean DG and has been most successful when coupled with other policies and programs. Consequently, states are promoting clean DG through a suite of related policies, including standard interconnection; addressing utility rates for standby, backup, and exit fees; creating renewable portfolio standards (RPS); and other initiatives. The Energy Policy Act of 2005 (EPAct 2005) directs states to consider their interconnection standards for DG within one year of enactment (by September 2006) and their net metering standards within two years of enactment (September 2007).

The state public utility commission (PUC), in determining utility interconnection rules, can establish uniform application processes and technical requirements that reduce uncertainty and prevent excessive time delays and costs that distributed generation (DG) can encounter when obtaining approval for electric grid connection.

Objective

The key objective of standard interconnection rules is to encourage the connection of clean DG systems (renewable and CHP) to the electric grid in order to obtain the benefits that they can provide without compromising safety or system reliability.

Benefits

Standardized interconnection standards can support the development of clean DG by providing clear and reasonable rules for connecting clean energy systems to the electric utility grid. By developing standard interconnection requirements, states make progress toward leveling the playing field for clean DG relative to traditional central power generation. Standard interconnection rules can help reduce uncertainty and prevent excessive time delays and costs that small DG systems sometimes encounter when obtaining approval for grid connection.

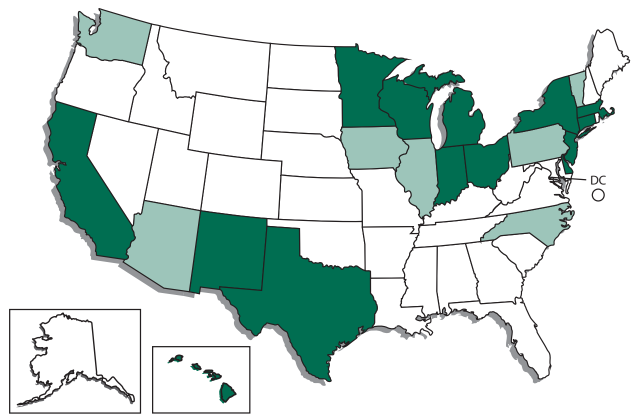
The benefits of increasing the number of clean DG projects include: enhancing economic development in the state,[24] reducing peak electrical demand, reducing electric grid constraints, reducing the environmental impact of power generation, and helping states achieve success with other clean energy initiatives. The application of DG in targeted load pockets can reduce grid congestion, potentially deferring or displacing more expensive transmission and distribution infrastructure investments. A 2005 study for the California Energy Commission (CEC) found that strategically sited DG yields improvements to grid system efficiency and provides additional reserve power, deferred costs, and other grid benefits (Evans 2005). Widespread deployment of DG can slow the growth-driven demand for more power lines and power stations.

States with Interconnection Standards

DG interconnections that do not involve power sales to third parties typically are regulated by states. The Federal Energy Regulatory Commission (FERC) regulates DG interconnections used to export power or for interstate commerce.[25] Since most DG is used to serve electric load at the customer's site, states approve the interconnection standards used for the majority of interconnections for smaller, clean DG systems.

As of November 2005, 14 states had adopted standard interconnection requirements for distributed generators (i.e., California, Connecticut, Delaware, Hawaii, Indiana, Massachusetts, Michigan, Minnesota, New Mexico, New Jersey, New York, Ohio, Texas, and Wisconsin), and seven additional states were in the process of developing similar standards (i.e., Arizona, Illinois, Iowa, North Carolina, Pennsylvania, Vermont, and Washington) (see Figure 5.4.1). While these standards often cover a range of generating technologies,

Figure 5.4.1: States with DG Interconnection Standards



States with interconnection rules
States with proposed interconnection rules

Notes:

- New Jersey also has interconnection standards for net metered renewable DG ≤ 2 MW.
- New Hampshire has interconnection standards for net metered renewable DG ≤ 25 kW.

Maximum System Size for a State Interconnection Standard			
CA	None	NH	25 kW
CT	25 MW	NJ	2 MW
DE	1 MW	NM	10 kW
HI	None	OH	None
MA	None	NY	2 MW
MI	None	TX	10 MW
MN	10 MW	WI	15 MW
NC[a]	100 kW		

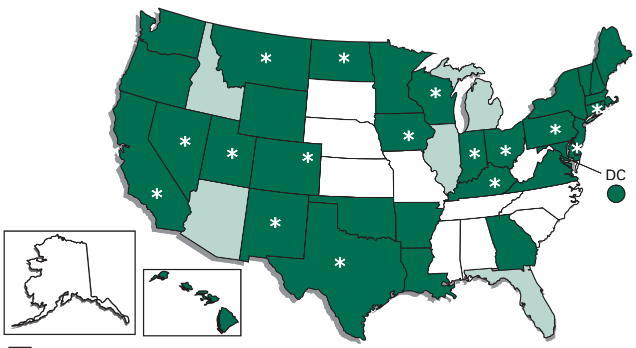
[a] System size is limited to 20 kW for residential customers.

Source: Navigant 2005.

[24] Economic development occurs through the increased number of DG facilities needed to meet electricity demand in the state and inducing companies to invest more in their facilities.

[25] Particularly those installations that are not interconnected to transmission systems or involved in third-party wholesale transactions.

Figure 5.4.2: States with Net Metering Rules



State-wide net metering for all utility types

* State-wide net metering for certain utility types (e.g., IOUs only)

Net metering offered by one or more individual utilities

Net Metering System Size Limit (kW) (in some cases limits are different for residential and commercial as shown)			
AR	25/100	MN	40
AZ	10	MT	50
CA	1,000	ND	100
CO	Under development	NH	25
CT	100	NJ	2,000
DC	100/25	NM	10
DE	Varies	NV	30
FL	Varies	NY	10/400
GA	10/100	OH	No limit
HI	50	OK	100
IA	Varies	OR	25
ID	25/100	PA	Varies
IL	40	RI	25
IN	10	TX	50
KY	15	UT	25
LA	25/100	VA	10/500
MA	60	VT	15/150
MD	80	WA	25
ME	100	WI	20
MI	Varies	WY	25

Source: IREC 2005.

most include interconnection of renewable and CHP systems.

In addition to interconnection requirements, many states have adopted net metering provisions. Most states find that smaller DG systems are more likely to produce power primarily for their own use, with exports to the grid tending to be incidental. These DG customers are at an economic disadvantage if the interconnect requirements are excessive. Also, small systems are more likely to have de minimus effects on the physical electric grid and on equity issues among customers, so the requirements needed for large generators are unnecessary in these instances. For these reasons, a simplified process has been adopted.

Net metering provisions can be considered a subset of interconnect standards for small scale projects. As of July 2005, 39 states and Washington, D.C. had rules or provisions for net metering (see Figure 5.4.2). When DG output exceeds the site's electrical needs, the utility may pay the customer for excess power supplied to the grid or have the net surplus carry over to the next month's bill. Some states allow the surplus account to be reset periodically, meaning that customers might provide some generation to the utility for free. Net metering provisions streamline interconnection standards but often are limited to specified sizes and types of technologies.

Some state net metering provisions are limited in scope. For example, net metering rules often apply only to relatively small systems,[26] specified technologies, or fuel types of special interest to policymakers. Some rules lack detailed specifications and procedures for utilities and customers to follow and vary across utilities within the state.[27] Several states, however, have net metering provisions and interconnection rules that provide a complete range of interconnection processes and requirements.[28]

[26] Thirty-four of 39 states that have net metering rules limit system sizes to 100 kW or less.

[27] States that have variable net metering policies among utilities include Arizona, Florida, Idaho, and Illinois.

[28] Some states (e.g., New Hampshire and New Jersey) have developed standard interconnection processes and requirements as part of their net metering provision.

Designing Effective Interconnection Standards

States consider a number of key factors when designing effective interconnection standards that balance the needs of DG owners, the utility company, and the public. These factors include promoting broad participation during standards development, addressing a range of technology types and sizes, and taking into consideration current barriers to interconnection. In addition, it is important to consider state and federal policies that might influence the development and operation of interconnection standards.

Participants

Key stakeholders who can contribute to the process of developing effective interconnection standards include:

- *Electric Utilities.* Utilities are responsible for maintaining the reliability and integrity of the grid and ensuring the safety of the public and their employees.
- *State PUCs.* PUCs have jurisdiction over investor-owned utilities (IOUs) and, in some cases, public-power utilities. They are often instrumental in setting policy to encourage onsite generation.
- *Developers of CHP and Renewable Energy Systems and Their Respective Trade Organizations.* Developers and their customers that will rely on these systems can provide valuable technical information and real-world scenarios.
- *Third-Party Technical Organizations.* Organizations such as the Institute of Electric and Electronic Engineers (IEEE) and certifying organizations like the Underwriters Laboratories (UL) have been active in establishing interconnection protocols and equipment certification standards nationwide.

Complicated Landscape of Interconnection for Distributed Generation

Renewable energy and CHP systems used by commercial or industrial facilities are typically smaller than 10 MW in capacity. When designing and implementing standards for systems of this size, it is important to realize that the size dictates how and by whom interconnection is regulated.

- *10 MW and larger systems: generally regulated by FERC.* Standards are being developed, or have already been developed, for larger systems that are often connected directly to the transmission grid and can be outside of a state's jurisdiction. Historically, most grid-connected generation systems were owned by electric utilities. As a result of restructuring and other legislation (e.g., the Public Utilities Regulatory Policy Act, PURPA), utilities were required to interconnect non-utility generators to the electric grid. States and regulatory agencies such as FERC have begun to develop or have already implemented standard interconnection rules for non-utility generators. However, most of these rules apply to larger generating facilities (> 10 MW).
- *100 kW systems and under: often covered to some degree by state net metering provisions.* Some states have developed provisions for net metering of relatively small systems (i.e., < 100 kW). While these provisions typically are not as comprehensive as interconnection standards, they can provide a solid starting point for industry, customers, and utilities with respect to connection of relatively small DG systems to the electric grid.
- *0.1–10 MW systems: require attention.* This "intermediate" group represents systems that are interconnected to the distribution system but are larger than the systems typically covered by net metering rules and smaller than the large generating assets that interconnect directly to the transmission system and are regulated by FERC. In response to the mounting demands by customers and DG/CHP developers to interconnect generation systems to the grid, utilities increasingly have established some form of interconnection process and requirements. In addition, to increase utility confidence around DG systems, industry organizations such as the IEEE and UL have begun to develop standards that enable the safe and reliable interconnection of generators to the grid. However, there is a need for states to establish standard interconnection rules for generation systems of all sizes.

- *Regional Transmission Organizations (RTOs).* These organizations may have already implemented interconnection standards using FERC requirements for large non-utility generators generally above 10 MW.
- *Other Government Agencies.* Federal agencies (e.g., FERC) and state environmental and public policy agencies can play an important role in establishing and developing interconnection standards.

Some states are bringing key stakeholders together to develop state-based standards via a collaborative process. For example, in Massachusetts, the Distributed Generation Collaborative (DG Collaborative) successfully brought together many diverse stakeholders to develop the interconnection rules now used by DG developers and customers in Massachusetts.

Typical Specifications

Interconnection standards typically specify:

- The type of technology that may be interconnected (e.g., inverter-based systems, induction generators, synchronous generators).
- The required attributes of the electric grid where the system will be interconnected (i.e., radial or network distribution, distribution or transmission level, maximum aggregate DG capacity on a circuit).
- The maximum system size that will be considered in the standard interconnection process.

Standard interconnection rules typically address the application process and the technical interconnection requirements for DG projects:

- The application process includes some or all parts of the interconnection process from the time a potential customer considers submitting an application to the time the interconnection agreement is finalized. For example, rules may specify application forms, timelines, fees, dispute resolution processes, insurance requirements, and interconnection agreements.
- Technical protocols and standards specify how a generator must interconnect with the electric grid. For example, requirements may specify that DG must conform to industry or national standards and include protection systems designed to minimize degradation of grid reliability and performance and maintain worker and public safety.

In addition, some states are developing different application processes and technical requirements for differently sized or certified systems. Since the size of a DG system can range from a renewable system of only a few kW to a CHP system of tens of MW, standards can be designed to accommodate this full range. Several states have developed a multi-tiered process for systems that range in size from less than 10 kW to more than 2 MW. Three states (Connecticut, Michigan, and Minnesota) have classified DG systems into five categories based on generator size. Other states use fewer categories, but also define fees, insurance requirements, and processing times based on the category into which the DG falls. The level of technical review and interconnection requirements usually increases with generation capacity.

In states with a multi-tiered or screen interconnection process, smaller systems that meet IEEE and UL standards or certification generally pass through the interconnection process faster, pay less in fees, and require less protection equipment because there are fewer technical concerns. States that require faster processing of applications for smaller systems ($\leq$ 10 to $\leq$ 30 kW) include California, Connecticut, Massachusetts, Michigan, Minnesota, New York, and Wisconsin. For relatively large DG systems, processes and requirements may be similar or identical to those used for large central power generators. For mid-size systems, states have found they may need to develop several levels of procedural and technical protocols to meet the range of needs for onsite generators, utilities, and regulators.

Constraints

Designing new DG interconnection rules provides an opportunity to resolve recurring barriers encountered by applicants for interconnection of DG systems. These barriers have been well-documented (NREL 2000, Schwartz 2005); three areas in which a DG developer typically confronts problems include:

- *Technical Barriers* resulting from utility requirements (including requirements for safety measures) regarding the compatibility of DG systems with the grid and its operation. For example, customers may be faced with costly electric grid upgrades as a condition of interconnection. Another frequently cited technical requirement that is particularly costly for smaller DG is the visible shut-off switch located outside the premises that can be accessed by the utility to ensure that no power is flowing from the DG unit. These shut-off switches range from $1,000 to $6,000 for small systems (e.g., 30 kW to 200 kW), depending on their location and whether they are installed as part of the original facility design or after the system began operations.
- *Utility Business Practices*, including issues that result from contractual and procedural interconnection requirements between the utility and the project developer/owner. For example, customers may face a long application review period or lengthy technical study requirements, with high associated costs.
- *Regulatory Constraints* arising primarily from tariff and rate conditions, including the prohibition of interconnection of generators that operate in parallel with the electric grid.[29] In some instances, environmental permitting or emission limits also can create barriers. For more information on the barriers posed to DG systems by tariff and rate issues, see Section 6.3, *Emerging Approaches: Removing Unintended Utility Rate Barriers to Distributed Generation*.

Some states are beginning to address these areas of concern through a combination of policy actions and regulatory changes to remove or alter requirements that they believe are not appropriate for the scale of small DG units.

Interaction with Federal Policies

States have found that several federal initiatives can be utilized when designing their own interconnection standards:

- In May 2005, FERC adopted interconnection standards for small DG systems of up to 20 MW. The rulemaking addresses both the application processes and technical requirements. Concurrently, through a separate rulemaking, FERC has addressed an application process and technical requirements for systems under 2 MW. States can use the new FERC standard interconnection rules as a starting point or template for preparing their own standards.[30]
- Under the Public Utilities Regulatory Policy Act (PURPA), utilities are required to allow interconnection by Qualifying Facilities (QFs).[31] Utilities may have standard procedures for such interconnection and some states may regulate such interconnection. New interconnect rules for DG may be more or less favorable than the existing regulations for QFs and also may not be consistent with existing rules for QFs. For example, in Massachusetts the application timelines and fees in the QF regulations are different than the DG interconnection tariff, which could create confusion and delay in establishing an interconnection.
- EPAct 2005 requires electric utilities to interconnect customers with DG upon request. The Act

29 When a CHP system is interconnected to the grid and operates in parallel with the grid the utility only has to provide power above and beyond what the onsite CHP system can supply.

30 FERC's interconnection rules, however, apply only to the third party and wholesale power transactions they regulate. Most DG systems fall under state, rather than FERC, jurisdiction, since most are connected at the distribution-system level and do not involve third-party exports via the utility grid.

31 A QF is a generation facility that produces electricity and thermal energy and meets certain ownership, operating, and efficiency criteria established by FERC under PURPA.

specifies that the interconnection must conform to IEEE Standard 1547, as it may be amended from time to time. In addition, the state regulatory authority must begin to consider these standards within one year of enactment (September 2006) and must complete its consideration within two years (September 2007). However, states that have previously enacted interconnection standards, have conducted a proceeding to consider the standards, or in which the state legislature has voted on the implementation of such standards do not have to meet these time frames.

- EPAct 2005 requires electric utilities to make available upon request net metering services to any electric customer. The state regulatory authority is required to consider net metering within two years of enactment (September 2007) and after three years of enactment must adopt net metering provisions (September 2008). However, states that have previously enacted net metering provisions, have conducted a proceeding to consider the standards, or in which the state legislature has voted on the implementation of such standards do not have to meet these time frames.

Interaction with State Policies

Interconnection standards are a critical complementary policy to other clean energy policies and programs such as state RPS (see Section 5.1, *Renewable Portfolio Standards*), clean energy fund investments (see Section 5.2, *Public Benefits Funds for State Clean Energy Supply Programs*), and utility planning practices (see Section 6.1, *Portfolio Management Strategies*).

Best Practices: Designing an Interconnection Standard

Best practices for creating an interconnection standard are identified below. These best practices are based on the experiences of states that have designed interconnection standards.

- Work collaboratively with interested parties to develop interconnection rules that are clear, concise, and applicable to all potential DG technologies. This will streamline the process and avoid untimely and costly re-working.
- Develop standards that cover the scope of the desired DG technologies, generator types, sizes, and distribution system types.
- Address all components of the interconnection process, including issues related to both the application process and technical requirements.
- Develop an application process that is streamlined with reasonable requirements and fees. Consider making the process and related fees commensurate with generator size. For example, develop a straightforward process for smaller or inverter-based systems and more detailed procedures for larger systems or those utilizing rotating devices (such as synchronous or induction motors) to fully assess their potential impact on the electrical system.
- Create a streamlined process for generators that are certified compliant to certain IEEE and UL standards. UL Standard 1741, "Inverters, Converters and Charge Controllers for Use in Independent Power Systems," provides design standards for inverter-based systems under 10 kW. IEEE Standard 1547, "IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems," establishes design specifications and provides technical and test specifications for systems rated up to 10 MW. These standards can be used to certify electrical protection capability.
- Consider adopting portions of national models (such as those developed by the National Association of Regulatory Utility Commissioners [NARUC], the Interstate Renewable Energy Council [IREC], and FERC) and successful programs in other states, or consider using these models as a template in developing a state-based standard. Also, consistency within a region increases the effectiveness of these standards.
- Try to maximize consistency between the RTO and the state standards for large generators.
- Developing consistency among states is important in reducing compliance costs for the industry based on common practices.

Implementation and Evaluation

This section describes the implementation and evaluation of new interconnection standards, including best practices that states have found successful.

Administering Body

While individual states may develop interconnection standards that are then approved by the PUC, utilities are ultimately responsible for their implementation.

Roles and Responsibilities of Implementing Organization

By establishing clearly defined categories of technologies and generation systems, utilities are able to streamline the process for customers and lessen the administrative time related to reviewing interconnection applications. For example, some states create multiple categories and tiers for reviewing applications with established maximum time frames. Across these technology categories, the maximum processing time allowed can vary by more than a factor of five depending on the technical complexity and size of the interconnection. Several states (including California, Connecticut, Massachusetts, Michigan, Minnesota, New York, and Wisconsin) have created tiered application processes based on system size and other factors. They have found that this tiered approach allows smaller systems a streamlined process while maintaining a standard process for larger systems.

- A *streamlined process* that applies to smaller[32] or simpler systems (e.g., inverter-based) could have lower fees, shorter timelines, and fewer requirements for system impact studies. In some cases, states have pre-certified certain devices (i.e., California and New York) or require compliance with UL 1741 or IEEE 1547 and other applicable standards (i.e., Connecticut, Massachusetts, Minnesota, New Jersey, and Texas) to expedite approval.
- Systems in a *standard process* are subject to a comprehensive evaluation. Applicants for these systems are typically required to pay additional fees for impact studies to determine how the DG may affect the performance and reliability of the electrical grid. Because of the higher degree of technical complexity, fees are higher and processing times are longer.

State Examples

There is no single way that states are approaching the interconnection of DG. In fact, there is tremendous diversity among the key elements of interconnection standards recently established at the state level. In the examples presented below, each state has different interconnection *application processes*, including fees, timelines, and eligibility criteria. Greater similarities are emerging among states' *technical requirements*, and this consistency is making it increasingly easier to increase the amount of clean DG in the states.

Massachusetts

In June 2002, the Massachusetts Department of Telecommunications and Energy (DTE) initiated a rulemaking to develop interconnection standards for DG. The policymakers within the DTE established a DG Collaborative to engage stakeholders (including utilities, DG developers, customers, and public interest organizations) to jointly develop a model interconnection tariff.

By adopting this model interconnection tariff, Massachusetts established a clear, transparent, and standard process for DG interconnection applications. The process uses pre-specified criteria to screen applications and establish application fees and timelines for DG systems of all types and sizes. The model interconnection tariff clearly specifies each step within the interconnection process and the maximum permissible time frames for each step. In addition, the model interconnection tariff provides for a

32 States that require faster processing of applications for smaller systems (≤ 10 kW to ≤ 30 kW) include California, Connecticut, Massachusetts, Michigan, Minnesota, New York, and Wisconsin.

> **Best Practices: Implementing an Interconnection Standard**
>
> The best practices identified below will help guide states in implementing an interconnection standard. These best practices are based on the experiences of states that have implemented interconnection standards.
>
> - Consider working as a collaborative to establish monitoring activities to evaluate the effectiveness of interconnection standards and application processes.
> - Periodically review and update standards based on monitoring activities, including feedback from utilities and applicants.
> - Keep abreast of changes in DG/CHP and electric utility technology and design enhancements, since these may affect existing standards, including streamlining the application process and interconnection requirements.
> - Consider working with groups such as IEEE to monitor industry activities and to stay up-to-date on standards developed and enacted by these organizations.

"simplified process" that allows most inverter-based systems that are 10 kW or less and are UL 1741 certified to be processed in less than 15 days without an application fee. Under the "standard process," used for larger DG systems that may have significant utility system impact, the process can take as long as 150 days and involve a $2,500 application fee in addition to other technical study and interconnection costs. The DG Collaborative also agreed to a five-step dispute resolution process in the event the interconnecting applicant is unable to reach agreement with the utility regarding the utility's decisions on the interconnection application.

After the adoption of the model interconnection tariff, the DG Collaborative reconvened to evaluate the reasonableness of the interconnection process by reviewing how the standard was functioning. The DG Collaborative examines application fees and time frames through a database structured to track interconnection applications. Although many applicants have successfully used the existing standard, the DG Collaborative has determined that it should review the application process and screening criteria in the model interconnection tariffs to further improve the process. This level of review is unique among states that have developed interconnection standards.

Web sites:
http://www.mass.gov/dte/restruct/competition/distributed_generation.htm (DTE DG interconnection proceedings)

http://www.masstech.org/policy/dgcollab/

New Jersey

The New Jersey Board of Public Utilities (NJBPU) has developed net metering and interconnection standards for Class I renewable energy systems. These rules became effective on October 4, 2004, and are separated into three levels. Each level has specific interconnection review procedures and timelines for each step in the review process.

- *Level 1* applies to inverter-based customer-generator facilities, which have a power rating of 10 kW or less and are certified as complying with IEEE 1547 and UL 1741.
- *Level 2* applies to customer-generator facilities with a power rating of 2 MW or less and certified as complying with IEEE 1547 and UL 1741.
- *Level 3* applies to customer-generator facilities with a power rating of 2 MW or less that do not qualify for Level 1 or Level 2 review.

Web site:
http://www.bpu.state.nj.us/cleanEnergy/cleanEnergyProg.shtml

New York

New York was one of the first states to issue standard interconnection requirements for DG systems. Enacted in December 1999, the initial requirements were limited to DG systems rated up to 300 kW connected to radial distribution systems.[33] New York recently modified these interconnection requirements to include

[33] A radial distribution system is the most common electric power system. In this electric power system, power flows in one direction from the utility source to the customer load.

interconnection to radial and secondary network distribution systems for DG with capacities up to 2 MW.

New York's Standard Interconnection Requirements (SIR) include a detailed 11-step process from the "Initial Communication from the Potential Applicant" to the "Final Acceptance and Utility Cost Reconciliation." Similar to other states with interconnection standards, the New York SIR includes separate requirements for synchronous generators, induction generators, and inverters. Notably, there is no application fee for DG systems rated up to 15 kW. For DG systems larger than 15 kW, the application fee is $350.

Web site:
http://www.dps.state.ny.us/distgen.htm

Texas

In November 1999, the Texas PUC adopted substantive rules that apply to interconnecting generation facilities of 10 MW or less to distribution-level voltages at the point of common coupling. This ruling applies to both radial and secondary network systems.

The rules require that Texas utilities evaluate applications based on pre-specified screening criteria, including equipment size and the relative size of the DG system to feeder load. These rules are intended to streamline the interconnection process for applicants, particularly those with smaller devices and for those that are likely to have minimal impact on the electric utility grid. For example, under certain conditions, if the DG interconnection application passes pre-specified screens, the utility does not charge the applicant a fee for a technical study. If the DG system is pre-certified,[34] the utility has up to four weeks to return an approved interconnection agreement to the applicant. Otherwise, the utility has up to six weeks.

Web site:
http://www.puc.state.tx.us/electric/business/dg/dgmanual.pdf

What States Can Do

States have adopted successful interconnect standards that expedite the implementation of clean energy technologies while accounting for the reliability and safety needs of the utility companies. Action steps for both initiating a program to establish interconnect rules and for ensuring the ongoing success of the rules after adoption are described below.

Action Steps for States

States That Have Existing Interconnection Standards

A priority after establishing standard interconnection rules is to identify and mitigate issues that might adversely impact the success of the rules. Being able to demonstrate the desired benefits is critical to their acceptance and use by key stakeholders. Strategies to demonstrate these benefits include:

- Monitor interconnection applications to determine if the standards ease the process for applicants and cover all types of interconnected systems. States can also monitor utility compliance with the new standards or create a complaint/dispute resolution point of contact.
- If resources permit, identify an appropriate organization to maintain a database on interconnection applications and new DG systems, evaluate the data, and convene key interconnection stakeholders when necessary.
- Modify and change interconnection rules as necessary to respond to the results of monitoring and evaluation activities.

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34 A pre-certified system is a known collection of components that has been tested and certified by a qualified third party (e.g., nationally recognized testing laboratory) to meet certain industry or state standards.

States That Do Not Have Existing Interconnection Standards

Political and public support is a prerequisite to establishing standard interconnection rules.

- Ascertain the level of demand and support for standard interconnection rules in the state by both public office holders and key industry members (e.g., utilities, equipment manufacturers, project developers, and potential system owners). If awareness is low, consider implementing an educational effort targeted at key stakeholders to raise awareness of the environmental and, especially, economic benefits resulting from uniform interconnection rules. For example, demonstrate that DG can result in enhanced reliability and reduced grid congestion. A 2005 study for the CEC found that strategically sited DG yields improvements to grid system efficiency, provides additional reserve power, deferred costs, and other grid benefits (Evans 2005). If resources are available, perform an analysis of these benefits and implement a pilot project (e.g., similar to Bonneville Power Authority's [BPA's] "non-wires" pilot program [BPA 2005] or the Massachusetts Technology Collaborative's [MTC's] Utility Congestion Relief Pilot Projects [RET 2005]) that promotes DG along with energy efficiency and voluntary transmission reduction. While this type of analysis is not essential, states have found it to be helpful.
- Establish a collaborative working group of key stakeholders to develop recommendations for a standard interconnection process and technical requirements. Open a docket at the PUC with the goal of receiving stakeholder comments and developing a draft regulation for consideration by the state PUC.
- If necessary, work with members of the legislature and the PUC to develop support for passage of the interconnection rules.
- Remember that implementing interconnection standards may take some years. States have found that success is driven by the inherent value of DG, which eventually becomes evident to stakeholders.
- Consider existing federal and state standards in the development process of new interconnection procedures and rely on accepted IEEE and UL standards to develop technical requirements for interconnection.

Related Actions

- For interconnection standards to be effective, tariffs and regulations that encourage DG need to be in place. If current tariffs and regulations discourage DG, then interconnection standards may not result in DG growth. Tariffs that encourage DG growth may allow customers to sell excess electricity back to the utility at or near retail rates. Key regulations that might discourage successful implementation of DG include high standby charges or back-up rates. Utility financial incentives that promote sales growth can discourage customers from making their own electricity and also discourage DG deployment. For more information on utility financial incentives, see Section 6.2, *Utility Incentives for Demand-Side Resources*.
- Communicate the positive results to state officials, public office holders, and the public.
- Include key stakeholders (e.g., utilities, equipment manufacturers, project developers, potential customers, advocacy groups, and regulators) in the development of the standard interconnection rules. Stakeholders can also contribute to rule modification based on the results of ongoing monitoring and evaluation.

Information Resources

State-by-State Assessment

Title/Description	URL Address
Database of State Incentives for Renewable Energy (DSIRE) is a resource for information on state interconnection policies. The Web site also provides comparative information on policies for each state.	http://www.dsireusa.org
Distribution and Interconnection Research and Development Program. This U.S. Department of Energy (DOE) program provides information and links to interconnection information in each state.	http://www.eere.energy.gov/distributedpower/interconnection_state.html

Federal Resources

Title/Description	URL Address
DOE's National Renewable Energy Laboratory (NREL) actively participates in many of the programs that create national standards for interconnection.	http://www.nrel.gov/programs/deer.html http://www.nrel.gov/eis/ http://www.nrel.gov/eis/standards_codes.html
The U.S. Environmental Protection Agency's (EPA's) CHP Partnership is a voluntary program that seeks to reduce the environmental impact of energy generation by promoting the use of CHP. The Partnership helps states identify opportunities for policy development (energy, environmental, economic) to encourage energy efficiency through CHP and can provide additional assistance to help states implement standard interconnection.	http://www.epa.gov/chp/

National Standards Organizations

Title/Description	URL Address
IEEE has developed standards relevant to many of the technical aspects of the interconnection. In particular, Standard 1547, *Interconnecting Distributed Resources with Electric Power Systems*, provides requirements relevant to the performance, operation, testing, safety considerations, and maintenance of the interconnection.	http://grouper.ieee.org/groups/scc21/1547/1547_index.html
UL also develops standards for interconnecting DG. In particular, UL 1741 will combine product safety requirements with the utility interconnection requirements developed in the IEEE 1547 standard to provide a testing standard to evaluate and certify DG products.	http://www.ul.com/dge/ http://www.eere.energy.gov/distributedpower/research/ul_1741.html

Examples of Standard Interconnection Rules

Title/Description	URL Address
IREC has prepared a model interconnection rule and a guide to connecting DG to the grid:	
Model Distributed Generation Interconnection Procedures and Net Metering Provisions	http://www.irecusa.org/connect/model_interconnection_rule.pdf
Connecting to the Grid: A Guide to Distributed Generation Interconnection Issues	http://www.irecusa.org/pdf/guide.pdf
Model Interconnection Tariff. Massachusetts adopted this model interconnection tariff to establish a clear, transparent, and standard process for DG interconnection applications.	http://www.mass.gov/dte/electric/02-38/515tariffr.pdf
Mid-Atlantic Distributed Resources Initiative (MADRI). In a collaborative process, MADRI has developed a sample interconnection standard.	http://www.energetics.com/MADRI/
NARUC has developed Model Interconnection Procedures and Agreement for Small Distributed Generation Resources.	http://www.naruc.org/associations/1773/files/dgiaip_oct03.pdf

Other Resources

Title/Description	URL Address
Distributed Generation in Oregon: Overview, Regulatory Barriers and Recommendations. L. Schwartz, PUC Staff, February 2005. This report by the Oregon PUC addresses barriers for DG.	http://www.puc.state.or.us/elecnat/dg_report.pdf
Making Connections: Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects. This NREL report studies the barriers projects have faced interconnecting to the grid.	http://www.nrel.gov/docs/fy00osti/28053.pdf
Optimal Portfolio Methodology for Assessing Distributed Energy Resources Benefits for the Energynet. CEC, PIER Energy-Related Environmental Research. CEC-500-2005-061-D. This project addresses whether distributed generation (DG), demand response (DR), and localized reactive power (VAR) sources, or distributed energy resources (DER), can be shown to enhance the performance of an electric power transmission and distribution system.	http://www.energy.ca.gov/2005publications/CEC-500-2005-061/CEC-500-2005-061-D.PDF
The Regulatory Assistance Project (RAP) prepared a Distributed Resource Policy Series to support state policy efforts, and facilitated the creation of a Model Distributed Generation Emissions Rule for use in air permitting of DG.	http://www.raponline.org/Feature.asp?select=13&Submit1=Submit http://www.raponline.org/Feature.asp?select=8&Submit1=Submit
The U.S. Combined Heat and Power Association (USCHPA) brings together diverse market interests to promote the growth of clean, efficient CHP in the United States. As a result, they have been stakeholders in states that have developed standard interconnection rules.	http://uschpa.admgt.com/statechp.html

State Resources

State	Title/Description	URL Address
California	California Public Utilities Commission (CPUC), Distributed Energy Resource Guide: Interconnection.	http://www.energy.ca.gov/distgen/interconnection/california_requirements.html
	CPUC Decision 00-12-037—Decision Adopting Interconnection Standards (Issued December 21, 2000).	http://www.cpuc.ca.gov/word_pdf/FINAL_DECISION//4117.pdf
Connecticut	Connecticut Department of Public Utility Control (DPUC) (DOCKET NO. 03-01-15).	http://www.dpuc.state.ct.us/DOCKHIST.htm
	Connecticut DPUC Decision—Investigation into the Need for Interconnection Standards for Distributed Generation (Issued April 21, 2004).	http://www.dpuc.state.ct.us/FINALDEC.NSF/2b40c6ef76b67c438525644800692943/d7a46f117bea965485256e7d0064e9a1/$FILE/030115-042104.doc
Delaware	Customer-Owned Generation Web site supported by the Delaware Division of the Public Advocate.	http://www2.state.de.us/publicadvocate/dpa/html/self_gen.asp
Hawaii	Customer Generation Interconnection Standards (Rule 14) maintained by the Department of Business, Economic Development, and Tourism.	http://www.hawaii.gov/dbedt/ert/interconnection/interconnection.html
	Docket No. 02-0051—Decision No. #19773 issued November 15, 2002, and Decision No. 20056 issued March 3, 2003.	http://www.hawaii.gov/dcca/areas/dca/dno/
Massachusetts	Massachusetts DTE Distributed Generation Web page.	http://www.mass.gov/dte/restruct/competition/distributed_generation.htm
	Massachusetts DTE 02-38-B—Investigation by the DTE on its own motion into Distributed Generation (Issued February 24, 2004).	http://www.mass.gov/dte/electric/02-38/224order.pdf
Michigan	Michigan Public Service Commission (PSC) Case No. U-13745.	http://www.cis.state.mi.us/mpsc/orders/electric/
	Michigan PSC Decision in Case No. U-13745, In the matter, on the Commission's own motion, to promulgate rules governing the interconnection of independent power projects with electric utilities. Issued July 8, 2003.	http://www.cis.state.mi.us/mpsc/orders/electric/2003/u-13745.pdf
Minnesota	Case File Control Sheet for Minnesota PUC Docket No. E-999/CI-01-1023.	http://www.puc.state.mn.us/docs/log_files/01-1023.htm
	Minnesota PUC, In the Matter of Establishing Generic Standards for Utility Tariffs for Interconnection and Operation of Distributed Generation Facilities under Minnesota Laws 2001, Chapter 212. Issued September 28, 2004.	http://www.puc.state.mn.us/docs/orders/04-0131.pdf
New Hampshire	New Hampshire Code of Administrative Rules, Chapter PUC 900, Net Metering for Customer-Owned Renewable Energy Generation Resources of 25 Kilowatt or Less. Effective January 12, 2001.	http://www.puc.state.nh.us/Regulatory/Rules/PUC900.pdf

State	Title/Description	URL Address
New Jersey	N.J.A.C 14:4-9, Net Metering and Interconnection Standards for Class I Renewable Energy Systems. Effective October 4, 2004.	http://www.state.nj.us/bpu/wwwroot/secretary/NetMeteringInterconnectionRules.pdf
New York	New York PSC DG Information.	http://www.dps.state.ny.us/distgen.htm
	New York PSC Case 02-E1282, Order Modifying Standardized Interconnection Requirements. Effective November 17, 2004.	http://www3.dps.state.ny.us/pscweb/webfileroom.nsf/0/C70957A0FD0B89FD85256F4E007449ED/$File/02e1282.ord.pdf?OpenElement
Ohio	The Public Utilities Commission of Ohio's Web page, Electric Distributed Generation Equipment: How to Connect to the Utility Company's System.	http://www.puco.ohio.gov/PUCO/Consumer/information.cfm?doc_id=115
	Ohio Administrative Code 4901:1-22 Interconnection Services.	http://onlinedocs.andersonpublishing.com/oh/lpExt.dll?f=templates&fn=main-h.htm&cp=OAC
Texas	Public Utility Commission of Texas Interconnection of Distributed Generation Project #21220.	http://www.puc.state.tx.us/rules/rulemake/21220/21220.cfm
	Public Utility Commission of Texas, Distributed Generation Interconnection Manual.	http://www.puc.state.tx.us/electric/business/dg/dgmanual.pdf
	Substantive Rules § 25.211 and § 25.212. Effective December 21, 1999.	http://www.puc.state.tx.us/rules/subrules/electric/index.cfm
Wisconsin	Wisconsin Administrative Code Chapter PSC 119, Rules for Interconnecting Distributed Generation Facilities. Effective February 1, 2004.	http://www.legis.state.wi.us/rsb/code/psc/psc119.pdf

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Navigant. 2005. Company intelligence. Navigant Consulting Inc. Also see: Katofsky, R. and L. Frantzis. 2005. Financing renewables in competitive electricity markets. *Power Engineering*. March 1.	http://www.navigantconsulting.com/A559B1/navigantnew.nsf/vGNCNTByDocKey/PPA91045514813/$FILE/Financing%20Renewables%20in%20Competitve%20Electricity%20Markets_Power%20Engineering_March%202005.pdf
NREL. 2000. Making Connections: Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects. NREL of DOE.	http://www.nrel.gov/docs/fy00osti/28053.pdf
RET. 2005. Renewable Energy Trust Web Site. Massachusetts Technology Collaborative (MTC): Congestion Relief Pilot Projects. Accessed November 2005.	http://www.masstech.org/renewableenergy/public_policy/DG/resources/CongestionReliefPilots.htm
Schwartz, L. 2005. Distributed Generation in Oregon: Overview, Regulatory Barriers and Recommendations. PUC Staff. February.	http://www.puc.state.or.us/elecnat/dg_report.pdf

5.5 Fostering Green Power Markets

Policy Description and Objective

Summary

Green power is a relatively small but growing market that provides electricity customers the opportunity to make environmental choices about their electricity consumption. Programs in more than 40 states currently serve approximately 540,000 customers, representing nearly 4 billion kilowatt-hours (kWh) annually. Green power is offered in both vertically integrated and competitive retail markets. Green power programs have existed for approximately 10 years and have contributed to the development of over 2,200 megawatts (MW) of new renewable capacity over that time. A recent study estimates that this could reach 8,000 MW by 2015 (Wiser et al. 2001).

Because participation in green power programs is voluntary, the role for states may be more limited than with other clean energy policy options, but it is still important. States can play a key role in helping to accelerate green power market development and increase overall participation levels. States can also ensure that green power markets complement other policies already in place, such as system benefits charge (SBC) funds and renewable portfolio standards (RPS). Overall, state support of green power markets can require less effort on the part of states than for other policies (e.g., RPS) and they can provide significant benefits when properly designed.

The approach taken depends on whether or not a state has vertically integrated or competitive retail electricity markets. For example, in vertically integrated markets, several states now require utilities to offer a green pricing tariff. Although signing up for green power service remains voluntary, this policy ensures that all customers have the option available to them.

In restructured markets, green power products are available from a range of competitive suppliers.

Voluntary green power markets promote the development of renewable energy resources and the renewable energy industry by giving customers the opportunity to purchase clean energy. States can play a key role in fostering the development of green power markets that deliver low-cost, environmentally beneficial renewable energy resources.

Customers may also increasingly be able to choose renewable energy as their default service by so-called "green check-off" programs.

In both vertically integrated and competitive markets, creating an environment favorable to green power can require the development of several policies and programs. For states interested in taking a more active role, this section outlines the suite of policies and programs to be considered.

Objective

The main objective of supporting development of green power markets is to increase the generation and use of renewable energy by giving customers the choice to support cleaner electricity generation options. Green power programs allow customers to support renewable energy development above and beyond the levels determined through the utility resource planning process or through state policies, such as RPS. Most green power products are designed to promote the development of new renewable energy capacity rather than providing support for existing capacity. Some of the underlying objectives of developing a green power market are to:

- Decrease the environmental impact of electricity generation.
- Help reduce the cost of renewable energy generation over time.
- Provide customers with choice, even in vertically integrated markets.
- Increase competition in restructured markets by increasing the number and type of green power options available to electric customers.

- Support development of local resources and associated economic development opportunities.
- Decrease energy price volatility, increase fuel diversity, and provide a hedge against future electricity price volatility.
- Reduce demand for fossil fuels, easing supply concerns.

State support for green power markets is also a complement to other renewable energy policies and programs such as RPS (see Section 5.1, *Renewable Portfolio Standards*). In this way, green power markets provide additional resources beyond the base provided by RPS and other policies.

Benefits

Green power markets support the development of renewable energy without imposing any additional costs on ratepayers (as a class). Generally, only those customers who choose to participate in the programs pay the premiums needed to cover the above-market costs of renewable energy. However, the economic and environmental benefits of green power accrue to all ratepayers.

Properly designed green power programs can be structured to facilitate the execution of long-term contracts for renewable energy, which is critical for project developers seeking to obtain financing for their projects.

To date, green power markets in the United States:

- Have resulted in the construction of more than 2,200 MW of new renewable capacity (see Figure 5.5.1).
- Are supporting the development of an additional 455 MW of renewable capacity in the near term.
- Have permitted more than 540,000 customers to choose green power.

Figure 5.5.1: Renewable Energy Capacity Added to Meet Voluntary Green Power Demand Through 2004

New[a] Renewable Capacity Supplying Green Power Markets				
Renewable Energy Resource	In Place		Planned[b]	
	MW	%	MW	%
Wind	2,045.6	91.6	364.5	80.1
Biomass	135.6	6.1	58.8	12.9
Solar	8.1	0.4	0.4	0.1
Geothermal	35.5	1.6	0.0	0.0
Small Hydro	8.5	0.4	31.3	6.9
Total	2,233.3	100.0	455.0	100.0

[a] New capacity refers to projects built specifically to serve green power customers or recently constructed to meet Green-e standards and used to supply green power customers. Includes utility green pricing and competitive green power products. Capacity installed to meet state RPS requirements is not included.

[b] Planned refers to projects that are under construction or formally announced.

Source: Bird and Swezey 2005.

- Have avoided the release of approximately 2.7 million tons of carbon dioxide (CO_2) in 2003 alone.[35]

Status of Green Power

There are two basic types of green power products: *bundled renewable energy* and *renewable energy certificates* (REC) (see box on page 5-61). Depending on whether a state has vertically integrated or restructured markets, bundled renewable energy is either available from utility green pricing programs or from competitive green power marketers, respectively. REC products are available to anyone in the United States.

As of 2003, utility green pricing programs were available in 34 states at over 500 utilities[36] and competitive green power products were available in restructured markets in nine states and Washington, D.C. through more than 30 green power marketers

[35] Based on an average CO_2 emission rate of 1,368 pounds per kilowatt-hour (lb/kWh) and 3.9 billion kWh of green power sales (emission rate was estimated from the Electric Power Annual 2003; DOE EIA 2004).

[36] Many are municipal utilities or cooperatives.

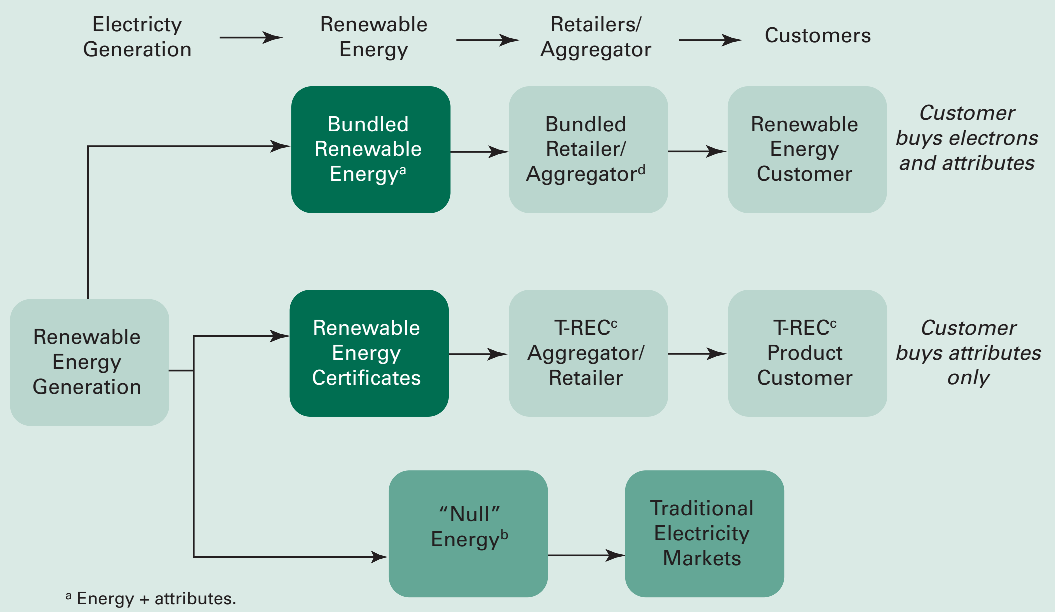
Types of Green Power Products

To fully understand the different types of green power products available to consumers, one must first understand the concept of *renewable energy certificates (RECs)*, also referred to as *green tags*, *green certificates*, *renewable energy credits*, and *tradable renewable certificates (T-RECS)*. RECs are used to value the attributes of renewable energy (i.e., the desirable properties of the renewable energy, such as low or zero emissions, and the fact that they are generated locally). The emergence of RECs as the "currency" for these attributes allows them to be separated from the power produced. Thus, a renewable energy generator now has two products to sell—electricity and RECs. From an economic perspective, the value of a REC can be used to cover the above-market cost of generating power from renewable energy. The value of a REC can also be used to differentiate different types of renewable energy (e.g., some customers may be willing to pay more for RECs generated from solar energy than from landfill gas). RECs are used for demonstrating compliance with renewable energy mandates (like RPS) or can be sold into voluntary markets, like green power.

There are two types of green power products (see figure below): bundled renewable energy and RECs. When a consumer purchases *bundled renewable energy*, he or she is purchasing both energy and attributes together. Thus, the value of the REC is included in the price of the green power. Alternatively, a consumer can purchase the attributes only (i.e., RECs only), while making no changes to his or her electricity purchases. The electricity associated with those RECs, now stripped of its attributes, is sold by the project owner into the market as ordinary electricity ("null energy").

Bundled renewable energy is sold in one of two ways. The term *utility green pricing* generally refers to an optional service or tariff offered by utilities to their own customers in vertically integrated electricity markets. *Green power marketing* refers to the selling of green power by competitive suppliers in competitive retail (restructured) markets.

Some REC-based electricity products are available to consumers located anywhere in the country. These RECs or T-RECs can be bought and sold at the wholesale level like other commodities, and also sold at the retail level to individual consumers. In addition to T-REC marketers and retailers, there are a number of brokers that serve this emerging REC market. The fact that there are T-REC marketers, retailers, and brokers demonstrates the importance of the concept of renewable energy attributes in helping realize the value of renewables in the marketplace.



[a] Energy + attributes.
[b] Energy without attributes.
[c] Tradeable Renewable Energy Certificate, also called a tradable renewable certificate.
[d] Includes regulated utilities.

Source: Katofsky 2005.

(Bird and Swezey 2004)[37] (see Figures 5.5.2 and 5.5.3). Combined, in 2003 these programs had annual sales of approximately 3.2 billion kWh.

In addition, 22 companies offered REC products in 2003. Sales in these programs represented an additional 700 million kWh in 2003.

While utility consumer participation rates are below 10%, green power markets continue to show significant annual growth.

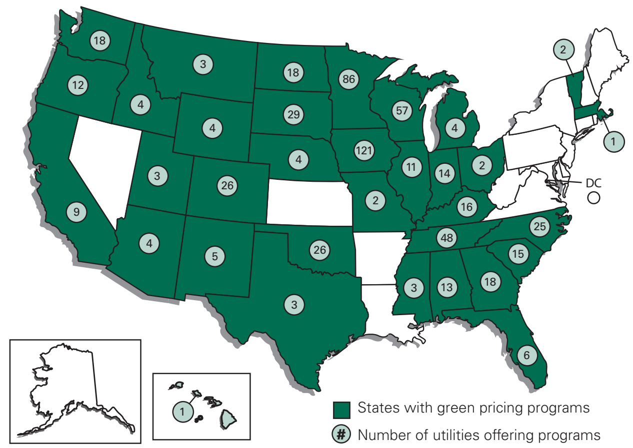
Creating a Favorable State Framework for Green Power Markets

States have found that green power markets are more effective when a number of complementary programs and policies are put in place. States have also learned that it is not sufficient to simply require that utilities provide a green pricing tariff or to open retail markets to competition in the hopes that this will attract green power marketers. This section outlines the suite of programs and options that states can use to create a favorable environment in which green power markets can grow.

Establishing the Program

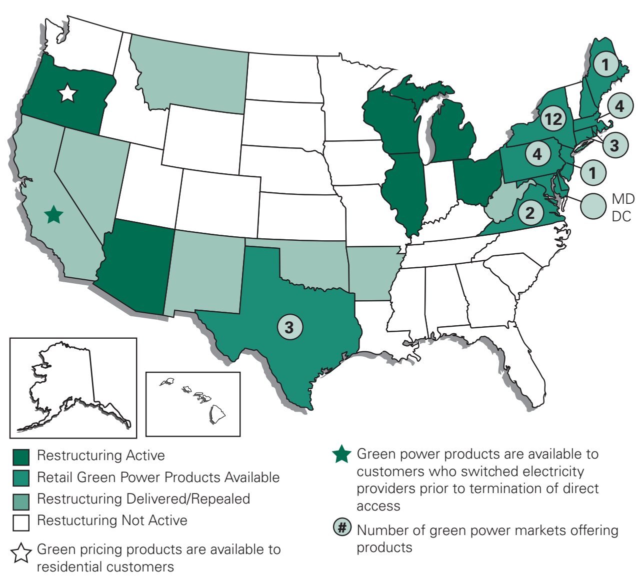
While purchasing green power is voluntary, some state legislatures (or if they have authority, state utility commissions) have taken an active role in making green power products available to consumers. The approach depends primarily on whether retail competition exists. In *vertically integrated markets*, some states have taken a first step by requiring that each utility develop and offer one or more green pricing tariffs. Participation in these programs remains voluntary. Some states have also required utilities to conduct education and outreach to help with market uptake as part of the utility's green power program.

Figure 5.5.2: States with Utility Green Pricing Activities



Source: DOE 2005b.

Figure 5.5.3: States with Green Power Marketing Activity in Competitive Electricity Markets[a]



a Represents bundled renewable electricity products available to residential and small commercial customers.

Source: DOE 2005a.

37 For an up-to-date list and statistics on green power markets, see the DOE Green Power Network Web site (DOE 2005).

In *restructured markets*, a green power mandate can require that all distribution companies act as a platform for green power marketers to more easily access customers receiving default service. These "green check-off" programs provide green power marketers access to electricity customers via utility bills, which eliminates the need for customers to switch electricity providers to purchase green power. For example, customers with low monthly electricity consumption lack options for obtaining green power in some locations. In addition, when competing with the default service, green power marketing companies can face high customer acquisition costs that can make the transaction uneconomical.

In some states, such as Pennsylvania and Texas, the retail market has been reasonably competitive and thus green power suppliers have entered the market to compete for customers with suppliers of traditional electricity. It is primarily in locations where retail competition has not developed that some states are requiring the default utilities to offer green power or provide a check-off program.

The green power product in check-off programs is typically provided by a third-party green power marketer. However, by involving the default service provider in green power marketing, it is possible for customers and renewable energy providers to have easier access to each other. Customers choosing to remain with their default service provider can now choose to purchase green power without having to take the additional step of choosing a new electricity supplier. Examples of states with green check-off programs include statewide coverage in New Jersey (beginning in October 2005) and select utilities in Massachusetts (see *State Examples* on page 5-67).

States can also consider setting quantitative goals and objectives for green power markets. For example, New Jersey set a target of doubling the number of green power customers by 2008, and Connecticut established a 0.5% voluntary green power target by 2008. States have also specified other aspects of the program, such as eligible technologies and resources, whether or not RECs can be used, and if and how cost recovery will be permitted on the part of utilities or retail electricity providers. As part of the process, a state can also outline roles and responsibilities of other parties, such as the state energy office and utility commission, set qualification and certification requirements for providers, and set standards for the green power products.

Roles for Stakeholders

Depending on the approach, a number of stakeholders have roles in fostering green power markets:

- *State Legislatures.* State legislatures have taken a role in enacting enabling legislation that would mandate and/or permit the development of green power offerings through utilities or distribution companies.
- *Public Utility Commissions (PUCs).* If they possess the authority, PUCs can mandate that utilities offer green power options. They are also responsible for approving utility green power tariff requests, and in competitive markets, ensuring that green power options are consistent with state rules regarding competition and supplier certification.
- *State Agencies and Independent Administrators of State SBC Funds.* These agencies and administrators may have a role in administering certain aspects of statewide green power initiatives and related programs (see *Key Supporting Policies and Programs* on page 5-64), ensuring consumer protection, and substantiating green power marketing claims.
- *Nonprofit Organizations.* Certain nonprofit organizations may also play important roles in information dissemination, consumer protection, and certification of green power products. For example, one source for independent certification of green power products is the Green-e program developed by the Center for Resource Solutions (Center for Resource Solutions 2005). In the Northeast,

SmartPower, working in collaboration with the Clean Energy States Alliance (CESA), has launched a major "Got Milk" style media campaign called "Clean Energy–Let's Make More!"

Key Supporting Policies and Programs

While requirements for utilities can be an important policy for advancing green power markets, a state can put in place additional, complementary policies. Some of the most important ones include:

- *Branding, Education, and Outreach*. These activities increase the level of awareness of green power and lead to higher participation rates. States have found that action-oriented messages that are linked directly to the available green power choices are the most effective.
- *Labeling and Disclosure.* These rules require that electricity providers include information about the fuel sources and emissions associated with the electricity they sell. This gives consumers information they can use to compare the impact of different electricity choices.
- *Green Power Customer Aggregation*. Aggregation is the formation of large customer buying groups that can collectively shop for green power supply. It provides a scale that can lead to lower prices and can also create the demand needed to support the entry of green power marketers. Examples include municipalities joining forces to meet their own power needs or municipalities acting as aggregators for their residents and businesses. Some religious organizations are also acting as aggregators (Bird and Holt 2002).
- *Consumer Protection***.** It is important that green power product claims be verified (e.g., with respect to the resource mix). This can include the use of third-party certification or other accepted standards. For example, in Massachusetts, the Clean Energy Choice program uses the same eligibility requirements and attribute tracking system as the state RPS.

Other Supporting Policies and Programs

In addition to the major policies listed above, other policies can also aid in creating robust green power markets, including:

- *State Green Power Purchases*. States can lead by example by committing to a certain amount of green power to meet their own needs. This demand can also help establish the market. The federal government is currently working to meet green power purchase targets that were set by executive order, and a growing number of state and municipal governments have set similar requirements. (For more information, see Section 3.1, *Lead by Example*.)
- *Small Customer Incentives*. States can provide incentives to green power marketers to offset customer acquisition costs or to provide rebates to customers to encourage them to sign up for green power. Several states have tied incentives to market transforming activities as opposed to straight subsidies. For example, the Massachusetts Renewable Energy Trust (MRET), working with the nonprofit group, the Massachusetts Energy Consumers Alliance (Mass Energy), has created a REC-based green power product for which the premiums are tax deductible on federal income tax returns (RET 2005). The Connecticut Clean Energy Fund (CCEF) and SmartPower, through its Clean Energy Communities Program, is offering municipalities free solar photovoltaic (PV) systems if (1) they commit to 20% of their electricity coming from clean energy resources by 2010, and (2) enough local businesses and residents sign up for the CTCleanEnergyOptions program (CCEF 2005).
- *Large Customer Benefits*. Additional benefits and incentives could also be offered to larger customers to encourage them to make substantial, long-term commitments to green power purchases. A proven option is to design a green power offering that can include long-term "hedge" value for green power customers, such as an exemption from utility fuel adjustment charges and potential future environmental control costs. Incentives can

also include providing commercial customers with recognition that provides them with visibility and brand value tied to their green power purchases.[38] Having large customers agree to long-term green power purchases also has the advantage of allowing green power providers to enter into long-term contracts with renewable energy project developers, which in turn helps them secure financing for their projects. One of the most successful programs in the United States—the GreenChoice program offered by Austin Energy—provides customers with the fixed-price attribute of the utility's renewable power purchase contracts.

- *Net Metering*.[39] This policy supports the development of customer-sited green power. These high-visibility projects can raise overall awareness of renewable energy and can also generate RECs or green power for sale through green power programs. For example, utilities and other green power providers can buy up (i.e., aggregate) the RECs from such projects and resell them under their green power offerings. For more information on net metering, see Section 5.4, *Interconnection Standards*.

Interaction with Federal Policies and Programs

While few significant interactions occur between green power programs and federal policies, some issues are described as follows.

Federal renewable energy incentives, such as the production tax credit (PTC), help reduce the cost of renewable generation and thus the price premium that green power customers must pay. Typically, these incentives are complementary to green power markets; the sale of renewable energy through a green power program does not make the project ineligible for federal incentives, such as the PTC and accelerated depreciation (Title 26 of the U.S. Code, Sections 45 and 168).

The U.S. Environmental Protection Agency's (EPA's) Green Power Partnership is a voluntary partnership between EPA and organizations that are interested in buying green power (http://www.epa.gov/greenpower). Through this program, EPA supports organizations that are buying or planning to buy green power. As a Green Power Partner, an organization pledges to replace a portion of its electricity consumption with green power within one year of joining the partnership.

EPA offers credible benchmarks for green power purchases, market information, and opportunities for recognition and promotion of leading purchasers. The goal of the Green Power Partnership is to facilitate the growth of the green power market by lowering the cost and increasing the value of green power.

A federal renewable energy goal was established by Executive Order 13123 (GSA 1999), which requires federal agencies to increase their use of renewable energy, either through purchases or onsite renewable energy generation. Thus, federal agencies can serve as key green power customers in states across the country.

The EPA Green Power Partnership started in 2001 with the commitment of 21 founding partners. Today there are more than 560 partners with annual green power commitments exceeding 2.5 billion kWh. Green Power Partners encompass a wide range of public and private sector entities, including the U.S. Air Force, Whole Foods Market, Johnson & Johnson, the city of San Diego, the World Bank, Staples, BMW, and the states of Illinois, Maryland, and Pennsylvania. For a complete list of partners, go to: http://www.epa.gov/greenpower/partners/gpp_partners.htm.

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38 Austin Energy's GreenChoice program is an example of a program that offers both benefits to business customers: replacement of the fuel adjustment charge with a fixed green power charge, and recognition through online acknowledgement at http://www.austinenergy.com/, print advertisements, EnergyPlus (printed customer newsletter), and billboard advertising.

39 Net metering enables customers to use their own generation to offset their electricity consumption over a billing period by allowing their electric meters to turn backwards when they generate electricity in excess of their demand. This offset means that customers receive retail prices for the excess electricity they generate.

Interaction with State Policies and Programs

There are important interactions between green power markets and existing or planned state policies and programs, as described below.

RPS have emerged as a widely used state-level policy in support of renewable energy (see Section 5.1, *Renewable Portfolio Standards*). Two key issues arise when considering support for green power markets in states with RPS. The first issue is whether renewable energy used to meet voluntary green power demand can also be used to meet RPS requirements. Specifically, if a utility sells renewable energy under a green power program to consumers, should it also be able to count that energy toward its RPS obligations? In most cases, the rules are written so that this is not permitted. Many voluntary green power purchasers have expressed concern that their personal investment in renewable energy is not used to help satisfy a mandate, but instead is contributing over and above any state requirements for renewable energy. For example, the New Jersey statewide green power program described in the *State Examples* section on page 5-67 contains language that specifically prohibits the sale of RECs used for RPS compliance in green power programs and vice versa.

Second, an RPS may create competition for limited renewable energy resources, making it harder for companies offering green power to find or develop renewable energy projects or to be able to source renewable energy at a reasonable price. The emergence of RECs as the currency for these RPS-related premiums, while beneficial overall to the renewable energy industry, is also leading to more liquidity, allowing renewable energy generators to sell their RECs to the highest bidder.

SBC funds (also called public benefits funds) are another widely used state level renewable energy policy. States can use some of these funds to support the development of robust green power markets through such activities as education and outreach, supporting the development of power projects that supply green power, and novel programs that encourage the use of green power (in *State Examples* section on page 5-67, see cases on Massachusetts, New Jersey, and Connecticut). For more information see Section 5.2, *Public Benefits Funds for State Clean Energy Supply Programs*.

The Role of Third Parties

Third parties can play a key role in the success of green power markets, including developing standards for green power products, providing independent certification of the products, and verifying marketer claims. There may also be a similar role for consumer advocacy groups. Having an independent organization provide program evaluation and monitoring can also be useful (see Connecticut in the *State Examples* section on page 5-68).

Program Implementation and Evaluation

States that have taken an active role in promoting green power have generally followed a number of steps in developing and evaluating green power programs:

- *Establish the Baseline*. Are consumers currently purchasing green power products? For example, even if there are no utility programs or competitive green power marketers, customers may be buying RECs from one of several national REC retailers.
- *Convene Potentially Interested Stakeholders in a Collaborative Process* to establish goals and other attributes of the program. This process can also be used to clearly outline the roles and responsibilities of all stakeholders. For example, Connecticut and New Jersey recently completed such processes (see *State Examples* section on page 5-67).
- *Regularly Evaluate the Success of Green Power Markets*. Possible metrics include the number of customers by customer class, kWh sold, MW of new generation developed, the cost of the green power premium, customer acquisition costs (a measure of program efficiency), the participation rate by customer class, and the number of marketers and

products available (a measure of market development and robustness).

Design issues to be considered include:

- What will be the cost premium charged for different product types (e.g., for different amounts of renewable energy content or different technology types)?
- Will green power be offered in fixed block sizes or as a percent of consumption?
- Does the program make use of bundled renewable energy or RECs (or both)?
- What length of time will customers be required to commit to when making a purchase?
- What are the appropriate geographic boundaries for eligible RECs and/or green power?
- How will cost recovery be dealt with?
- What type of product certification, if any, will be required?
- What types of projects, technologies, and resources will be eligible?

State Examples

The examples that follow were selected to show the diversity of policies and programs that states are using to create environments favorable to green power. Ultimately, each state will develop a set of policies and programs that best meets their specific needs.

New Jersey

New Jersey is an example of a restructured state using multiple policies to increase the development and use of renewable energy in the East. It already has an RPS and SBC fund in place, and has also set additional renewable energy goals with respect to in-state installation of renewable energy, technology cost reduction, job creation, and new manufacturing capability. In addition, the New Jersey Clean Energy Council set a goal to double the number of electric customers purchasing green electricity and increase the load served by qualified renewable resources by 50% over and above the Class I RPS.

Best Practices: Designing and Implementing Green Power Programs

Although green power programs are often implemented through utilities or green power marketers, states can play a major role in program design and in setting up the green power market structure. Some key considerations when designing and implementing a program include:

- Learn from other states' experiences to identify the most appropriate approach for your state.
- Encourage new resources to ensure that renewable benefits are realized.
- Create real value for green power customers, such as exempting them from utility fuel adjustment charges.
- For commercial customers, consider recognition programs to add value to their purchases.
- Create programs with sufficiently long time horizons to encourage and facilitate long-term contracting for power—a critical requirement for project developers to obtain financing for new power projects.
- Determine the appropriate relationship between green power purchases and compliance with RPS.
- Involve key stakeholders and experts in a collaborative design effort.
- Base program designs on your state's market characteristics and customer needs.
- Keep the program design simple and clear, while ensuring that the program leads to real benefits (e.g., development of new renewable energy capacity, emission reductions).

To support this goal, the state implemented a statewide green check-off program, the Green Power Choice Program (GPCP), which began October 1, 2005. The program requires utilities to offer retail electricity customers the option of selecting an energy product with a higher level of renewable energy than required by the state RPS. Through this program, green power is made available to all customers in the state using a sign-up option on electric bills–an example of a check-off program. This green power product must use renewable energy not otherwise allocated to meeting RPS requirements and must have full disclosure of the power's content.

New Jersey is the first state with restructured electricity markets to institute such a statewide voluntary green power program. As such, it is expected to result in lower marketing costs on a per-customer and per-kWh basis. However, it is also the first program to involve multiple utilities and multiple green power providers, which may result in additional costs associated with coordination and planning. If necessary, utilities can apply to recover the costs related to setting up and managing the GPCP. In addition, New Jersey is playing an important role with regard to setting up the mechanisms to certify and verify the attributes of the green power sold to customers.

Web site:
http://www.bpu.state.nj.us/cleanEnergy/GreenPowerChoice.shtml

Connecticut

Connecticut, like New Jersey, is a restructured state. However, Connecticut has both competitive and standard offer providers selling green power products. Connecticut has a Clean Energy Collaboration made up of key stakeholders including marketers, nonprofit organizations, utility companies, state agencies, and others supporting green power market development. Connecticut is also an example of a state that is using its SBC fund to promote voluntary green power market development.

Connecticut has established two voluntary green power market targets: (1) 0.5% (~150 gigawatt-hours [GWh]) by the end of 2007 through the CCEF, and (2) 3% to 4% (~900 GWh) by the end of 2010 through the *Connecticut Climate Change Action Plan 2005*. To assess green power market development, the CCEF has hired an independent third party to monitor and evaluate public awareness and voluntary green power market development in the state.

To support Connecticut's voluntary green power market, several marketing and incentive programs have been initiated, including:

- *SmartPower's Clean Energy–Let's Make More* television and radio ads and the 20% by 2010 clean Energy Campaign. Connecticut and New Haven are key campaign participants.
- *CCEF's Clean Energy Communities* program provides free solar PV systems to SmartPower-qualifying municipalities who (1) commit to SmartPower's 20% by 2010 Clean Energy Campaign, and (2) sign up a specific number of customers to the CTCleanEnergyOptions program. Several towns have already qualified.
- *Sterling Planet's Investment for the Greater Good* program offers rewards to nonprofit organizations, municipalities, and colleges and universities supporting green power by providing a 10% cash rebate for eligible purchases. In addition, eligible organizations may also receive 10% cash back on any residential enrollment they secure.

Connecticut's collaborative model has shown early signs of positive results, with approximately 3,000 sign-ups in two months with the new CTCleanEnergyOptions program.

Web site:
http://www.ctcleanenergyoptions.com/

Massachusetts

Massachusetts, like New Jersey, is a restructured state. However, unlike New Jersey, the retail providers in Massachusetts are not required to offer customers a green power option. Rather, to increase consumer demand for green power, the Massachusetts Technology Collaborative (MTC) is developing creative ways to use SBC funding to promote green power.

The MTC, a nonprofit group, manages the SBC funds for renewable energy in Massachusetts and has a general mandate to increase renewable energy supply and use in the state. To create consumer demand for green power, the MTC developed the Clean Energy Choice program.

The Clean Energy Choice program bundles together a number of features to increase consumer confidence in both green power and the value of green power to them. First, the Clean Energy Choice program identifies credible sources of green power for customers, thereby reducing their risk and simultaneously increasing their confidence in the authenticity of the green power marketer claims. Specifically, the Clean Energy Choice program requires that green power providers use the same definition of renewable energy used in the state's RPS. Second, participants that purchase green power from one of the providers (e.g., Mass Energy) are able to deduct the incremental cost of their green power purchase (i.e., the premium) from their federal income tax.[40] By providing customers with a tax deduction, the Clean Energy Choice program effectively reduces the customer's cost premium for green power by about one-third. Third, the Clean Energy Choice program matches, dollar for dollar, customers' green power premiums with grant payments to their local municipal governments for use in developing additional renewable energy projects. The payment received by a municipality is equal to the amount paid for green power by its residents, up to a total annual grant program cap of $1.25 million. Finally, the Clean Energy Choice program offers matching grants for clean energy projects serving low-income residents throughout the state, subject to a $1.25 million annual program cap. Thus, up to $2.5 million in SBC funds, roughly 10% of the annual SBC funds collected, is being used to promote voluntary green power in Massachusetts.

In the Clean Energy Choice program, consumers have two basic choices. First, there are already three utilities that provide a green power option directly to their customers, with several different products available to them. These utilities include Mass Electric, Cape Light Compact, and Nantucket Electric. The incremental monthly cost of green power is approximately $6 to $12. Second, customers throughout the state (including customers of the above utilities) can purchase RECs from Mass Energy. Under the Mass Energy program, a 500 kWh block of RECs costs $25.

Web site:
http://cleanenergychoice.org/

Washington

Washington has a vertically integrated market for electricity. It provides an example of state-mandated utility green pricing programs created via legislation. In 2001, the governor signed a bill that required all electric utilities to offer customers renewable energy options. The bill stipulates that utilities must regularly promote the option of either fixed or variable rates for voluntary green power in monthly billing statements.

As a result of this 2001 legislation, today there are 17 utilities in Washington that offer voluntary green power to their customers. As shown in Table 5.5.1, green pricing programs vary according to each utility's unique circumstances.

To provide one example, Puget Sound Energy's (PSE's) Green Power Program currently has over 14,000 commercial and residential customers. In 2004, these customers bought more than 46 million kWh of green power, enough renewable energy to serve approximately 4,000 homes for a year. Given this program's success, it was rated one of the top 10 voluntary green power programs nationwide in 2004 (DOE 2005c). PSE offers green power that is produced in the Pacific Northwest from wind and solar facilities. PSE's program allows customers to select the amount of green power they want. Options are available as low as $4 per month for 200 kWh of green power. Each additional block of 100 kWh is sold at a price of $2. For under $10 a month, a household can "green" approximately 30% to 50% of their electricity (based on 1,000 kWh per month usage).

40 Mass Energy is a nonprofit organization and the MTC is a state agency. By a private letter ruling from the Internal Revenue Service (IRS), the MTC was able to classify the premiums paid for renewable energy purchased as a charitable contribution.

Web sites:
http://www.dsireusa.org/library/includes/map2.cfm?CurrentPageID=1&State=WA

http://www.eere.energy.gov/greenpower/markets/state_policies.shtml

New Mexico

New Mexico, like Washington, has a vertically integrated electricity market. It provides an example of a state-mandated utility green pricing program created via regulatory authority. By unanimous approval in 2002, the New Mexico Public Regulation Commission (PRC) created regulations that require all investor-owned utilities and electric cooperatives in the state to offer their customers a voluntary renewable energy tariff. (Cooperatives only have to provide renewable energy to the extent that renewable energy is available to them from their suppliers.) To raise

Table 5.5.1: Green Pricing Programs Offered in Washington *(as of May 2005)*

Utility Name	Program Name	Type	Start Date	Premium
Avista Utilities	Buck-A-Block	Wind	2002	0.33¢/kWh
Benton County Public Utility District (PUD)	Green Power Program	Landfill gas, wind	1999	Contribution
Chelan County PUD	Sustainable Natural Alternative Power	PV, wind, micro hydro	2001	Contribution
Clallam County PUD	Green Power Rate	Landfill gas	2001	0.7¢/kWh
Clark Public Utilities	Green Lights	PV, wind	2002	1.5¢/kWh
Cowlitz PUD	Renewable Resource Energy	Wind, PV	2002	2.0¢/kWh
Grant County PUD	Alternative Energy Resources Program	Wind	2002	2.0¢/kWh
Grays Harbor PUD	Green Power	Wind	2002	3.0¢/kWh
Lewis County PUD	Green Power Energy Rate	Wind	2003	2.0¢/kWh
Mason County PUD No. 3	Mason Evergreen Power	Wind	2003	2.0¢/kWh
Orcas Power & Light	Go Green	Wind, small hydro, PV	1997	3.5¢/kWh
Pacific County PUD	Green Power	Wind, hydro	2002	1.05¢/kWh
Pacificorp: Pacific Power	Blue Sky	Wind	2000	1.95¢/kWh
Peninsula Light	Green by Choice	Wind, hydro	2002	2.8¢/kWh
Puget Sound Energy	Green Power Plan	Wind, solar	2002	2.0¢/kWh
Seattle City Light	Seattle Green Power	Solar, wind, biogas	2002	Contribution
Snohomish County PUD	Planet Power	Wind	2002	2.0¢/kWh
Tacoma Power	EverGreen Options	Small hydro, wind	2000	Contribution

Source: DOE 2005.

awareness and demand for voluntary green power, utilities are also required to develop educational programs for customers on the benefits and availability of their voluntary renewable energy programs.

The renewable energy tariffs allow consumers the option of purchasing more renewable energy than what is required by the RPS. Tariffs offered by utilities and cooperatives in New Mexico range from 1.8 to 3.2 cents/kWh and combine varying mixes of wind, solar, and biomass, depending on the utility. In addition, some utilities offer green power produced only within the state, while others offer green power produced in New Mexico and in surrounding states. In 2004, the state legislature passed SB43, which provides additional guidance to the PRC and explicitly states that voluntary green power sales would need to be in addition to the state's RPS requirements.

Web sites:
http://www.nmprc.state.nm.us/utility/pdf/3619finalrule.pdf

http://legis.state.nm.us/Sessions/04%20Regular/bills/senate/SB0043.html

What States Can Do

The suite of policies and programs that can be used to create robust green power markets and help clean energy contribute to state goals is well understood. States can use the best practices and information resources in this *Guide to Action* to actively promote green power market development and to strengthen existing programs to deliver even more benefits to electricity customers.

Action Steps for States

States with a Competitive Retail Market

- Assess how well competitive markets are working with regard to green power product availability, quality, and uptake.
- If markets are not working to support green power, consider ways to support their development, as outlined in this document.
- Ensure that other state programs and policies are aligned with the needs of the green power marketplace.

States with a Vertically Integrated Retail Market

- Consider a process to evaluate whether to require utilities to offer a green pricing option to all customers, and if so, how to design this option (customer participation would still be voluntary).
- Develop a green pricing program that meets your state's particular situation.
- Ensure that other state programs and policies are aligned with the needs of the green power marketplace.

Information Resources

General Information

Title/Description	URL Address
Green Pricing Resource Guide, Second Edition. This guide focuses on utility green pricing programs, although most of the insights apply or can be adapted to green power marketing in restructured markets, and to a much lesser extent to renewable energy certificates.	http://www.awea.org/greenpower/greenPricingResourceGuide040726.pdf
National Council Series on Information Disclosure. The National Council's research program addresses disclosure of information to consumers who will choose retail electricity providers in restructured states. The Council has published several reports on this topic in draft format. Final published National Council reports will soon be posted on their Web site.	http://www.Ncouncil.org/pubs.html
Power to the People: How Local Governments Can Build Green Electricity Markets. This assesses the benefits and potential obstacles to green aggregation by local governments, while noting the potential of municipal aggregation in general to protect and benefit small power consumers.	http://www.repp.org/repp_pubs/articles/issuebr9/index_ib9.html
Trends in Utility Green Pricing Programs (2003). This report presents year-end data on utility green pricing programs, and examines trends in consumer response and program implementation over time.	http://www.eere.energy.gov/greenpower/pdfs/36833.pdf
Utility Green Pricing Programs: Design, Implementation, and Consumer Response. The purpose of this report is to provide aggregate industry data on consumer response to utility programs, which indicate the collective impact of green pricing on renewable energy development nationally, and market data that can be used by utilities as a benchmark for gauging the relative success of their green pricing programs.	http://www.eere.energy.gov/greenpower/resources/pdfs/nrel_35618.pdf

Federal Resources

Title/Description	URL Address
EPA Green Power Partnership. This is EPA's voluntary program to promote the use of green power by companies, government agencies, and other institutions.	http://www.epa.gov/greenpower
U.S. Department of Energy (DOE) Green Power Network. This is the link to the main Web site of the Green Power Network.	http://www.eere.doe.gov/greenpower

Information About States

Title/Description	URL Address
CESA. Twelve states across the United States have established funds to promote renewable energy and clean energy technologies. CESA is a nonprofit organization that provides information and technical services to these funds and works with them to build and expand clean energy markets in the United States.	http://www.cleanenergystates.org/

Title/Description	URL Address
Database of State Incentives for Renewable Energy (DSIRE). This Web site contains extensive information on federal, state, and local programs, policies, and incentives for renewable energy. The database can be searched by program type, including green power programs.	http://www.dsireusa.org
DOE Green Power Network. This reference links to information about state green power programs (i.e., states that have taken an active role in fostering green power) and power disclosure policies.	http://www.eere.energy.gov/greenpower/markets/states.shtml
Massachusetts Clean Energy Choice Program. This Web site describes the voluntary green power program being promoted by the MTC, the administrator of the state's system benefits fund. It includes descriptions of the green power offerings, and incentive programs offered by the MTC.	http://cleanenergychoice.org
Washington State Utilities and Transportation Commission (UTC) Green Power Programs. This reference links to the main page of the Washington green power programs, providing links to the enabling legislation, annual reports on the green power programs, and utility green pricing tariffs.	http://www.wutc.wa.gov/webimage.nsf/071d50fefd435186882567ad00778646/2a75cd42e959364288256ab000749d8b!OpenDocument

Examples of State Legislation and Regulations

State	Title/Description	URL Address
New Jersey	**State of New Jersey Board of Public Utilities, Order of Approval in the Matter of a Voluntary Green Power Choice Program. Docket No. E005010001**. This document contains the final New Jersey Board of Public Utilities (NJBPU) approval for the statewide green power program and also includes the document containing the final program description, framework, rules, and technical standards.	http://www.bpu.state.nj.us/wwwroot/cleanEnergy/EO05010001_20050413.pdf
New Mexico	**New Mexico legislation (S.B.43) supporting the RPS and voluntary green power programs**. This reference links to state legislation (Senate Bill 43, called the "Renewable Energy Act"). It further clarifies elements of the state RPS and also specifies that sales through the voluntary green pricing programs are in addition to the RPS requirements (see Section 7).	http://legis.state.nm.us/Sessions/04%20Regular/bills/senate/SB0043.html
	New Mexico utility commission final rule requiring the development of voluntary green power offerings (see Section 10.D). This reference links to the New Mexico PRC final rule that established the New Mexico RPS. In Section 10.D, it also requires utilities to offer a voluntary green pricing tariff to its customers.	http://www.nmprc.state.nm.us/utility/pdf/3619finalrule.pdf
Washington	**Revised Code of Washington (RCW) 19.29A.090: Voluntary Option to Purchase Qualified Alternative Energy Resources**. This is the enabling legislation for the Washington State UTC green power program.	http://www.leg.wa.gov/RCW/index.cfm?section=19.29A.090&fuseaction=section

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Center for Resource Solutions. 2005. Green-e renewable electricity certification program Web site (includes links to documents covering green power standards, verification, as well as certified products).	http://www.green-e.org/
DOE. 2005. The Green Power Network Web site (includes links to information on existing utility green pricing programs, green power marketer programs, and summaries of state policies on green power and disclosure). Accessed July 2005.	http://www.eere.energy.gov/greenpower/
DOE. 2005a. The Green Power Network Web Site. Information Resources: Green Power Marketing Activity in Competitive Electricity Markets. July 2005.	http://www.eere.energy.gov/greenpower/resources/maps/marketing_map.shtml
DOE. 2005b. The Green Power Network Web Site. Information Resources: Utility Green Pricing Activities. July 2005.	http://www.eere.energy.gov/greenpower/resources/maps/pricing_map.shtml
DOE. 2005c. Green Power Markets Web site. Green Pricing: Top Ten Utility Green Power Programs. December 2005.	http://www.eere.energy.gov/greenpower/markets/pricing.shtml?page=3
DOE EIA. 2004. Electric Power Annual 2003. U.S. DOE Energy Information Administration. December.	http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html
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Katofsky, R. 2005. Personal communication with Ryan Katofsky, Navigant Consulting, July 2005.	N.A.
RET. 2005. Renewable Energy Trust Web site. Tax Deductible Option Why Are Some Choices Tax Deductible? Accessed July 2005.	http://www.cleanenergychoice.com/tax_deduct1.htm
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